Editorial

DURING the past 12 months, Australian radio amateurs had cause to congratulate themselves on their splendid work in national emergencies, particularly those arising from the serious floods in various parts of New South Wales.

These occasions revealed a number of important facts about the actual and potential value of the amateur to the community.

It showed quite clearly that amateurs are able and willing to place everything they have at the disposal of the control authorities.

It showed that the amateur is able to fill a breach when the absence of official radio channels, or their unpredictable isolation caused by the emergency, make other communication impossible at least during vital periods.

But there is a danger that, without careful and planned organisation, the amateur could easily nullify his potential good work through over-enthusiasm, lack of direction or thoughtlessness. At all costs, this must not be allowed to happen.

The Wireless Institute of Australia is well aware of this danger. It has seen quite clearly the need for planning before the occasion in order to avoid regrets when all is over. More than this, it is well advanced in organising emergency networks, at least in New South Wales.

This is a logical step, and an essential one if the full weight of amateur services is to be realised.

It is of little value, however, for keen and well-trained men to be ready with their networks, operating on frequencies set aside for them, if those not actually in the net do not know what not to do. Thoughtless or uninformed interference from such men can render months of planning, rehearsal, and effort completely useless.

It is, therefore, essential that every amateur in Australia should know what is going on, and the frequencies upon which emergency communication will take place, if interference with vital traffic is to be avoided. When the emergency plans have been finalised, and if possible made uniform throughout the land, every licensed amateur should make it his business to know the procedure. If he cannot take part, because of his remote position, he can at least be certain that he will not ruin the work of those who can.

Only by a full appreciation of emergency work can every amateur ensure that he will serve, even if his part is to stand by and wait.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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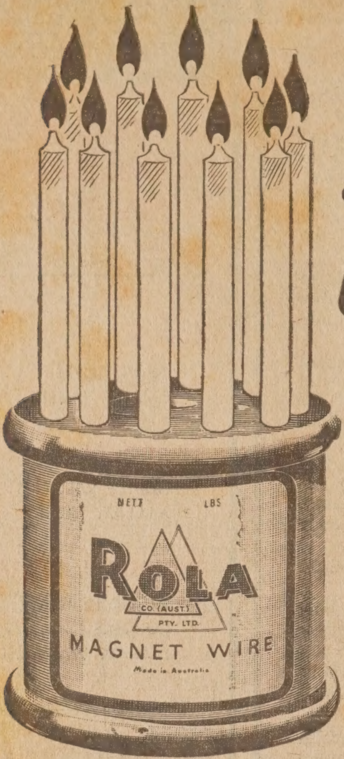
OUR COVER PICTURE

Work on sensitive meter movements calls for a watchmaker's precision and skill. In the photograph, an operator is shown making final adjustments to a horizontal type instrument.



We Celebrate a 10th Birthday

This year marks a decade in the history of a new Australian industry—the manufacture of Magnet Winding wires—which was pioneered by Rola Co. (Aust.) Pty. Ltd., in 1940 when, to forestall potential war time shortages in the Australian Electrical Industry, it installed the first units of a modern wire making plant.

Despite the claims by some local experts, repeated at a 1941 Tariff Board enquiry, that the manufacture of Magnet Winding wires in Australia was uneconomic, the new enterprise was a success from the start.

To date more than 12,000,000 pounds of Rola Magnet Winding wires have been supplied to Australian Radio and Electrical Manufacturers and the company is still pioneering new developments in magnet wire techniques.

Most important of all, this new Australian industry has become firmly established—there are now three independent manufacturers of Magnet Winding wires in the Commonwealth—and Australia has made another important step on the road to self sufficiency.

**ROLA CO. (Aust.) Pty. Ltd., The Boulevard,
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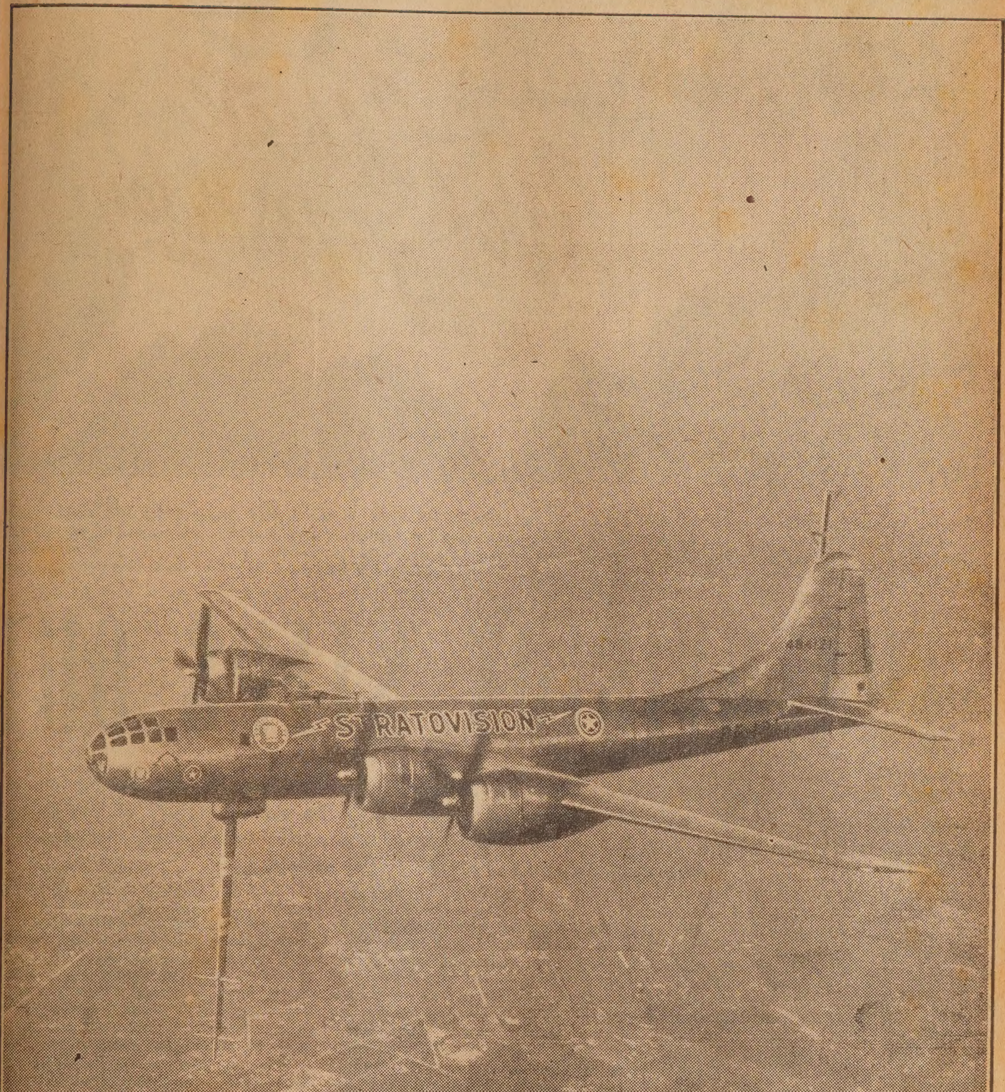
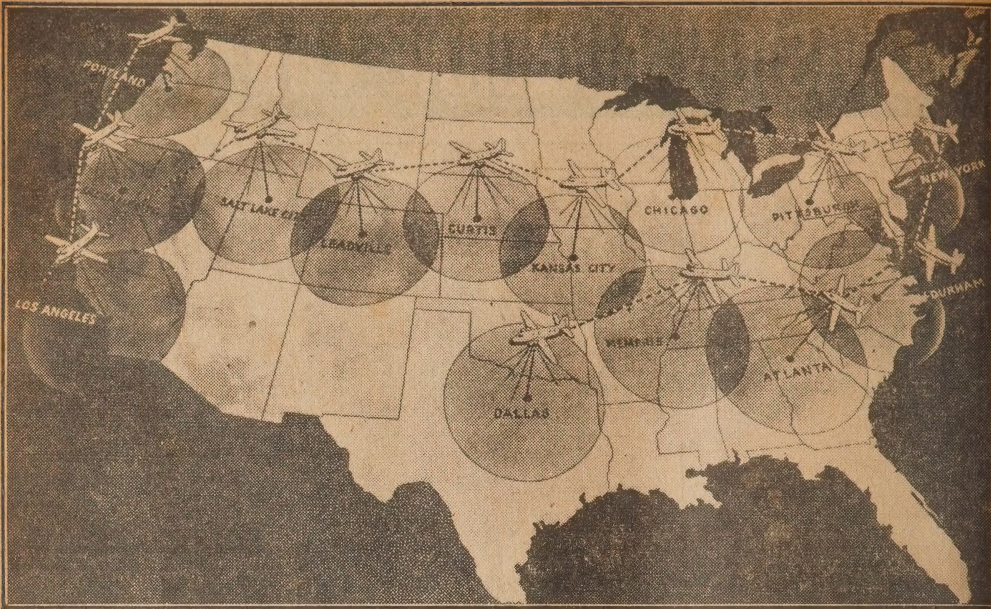
TELEVISION AIRBORNE FOR RANGE



WILL AIRBORNE STATIONS SOLVE THE PROBLEM OF LONG RANGE TELEVISION?—An experimental Stratovision station—a modified B-29—flying at 25,000 feet near Pittsburgh in the eastern State of Pennsylvania, re-broadcasts programmes beamed from ground stations of the east-coast television network. Programmes are picked up by the antenna projecting above the aeroplane's tail. Re-broadcasts are from the long mast-line antenna at the nose. (See story on next page.)



Airborne Stratovision stations make possible a coast-to-coast television network in the United States which will reach even remote and isolated farm homes. In the network illustrated, programmes originating in ground studios are beamed to the planes which relay them (dotted lines) from plane to plane. Each plane re-broadcasts the programme, covering an area of an estimated 525 square miles (shaded areas). Nine programmes can be received and broadcast by each plane simultaneously.

STRATOVISION STEPS OUT

One of the big problems associated with television concerns the difficulty of covering more than local areas with reliability. The chief limitation here is the optical nature of the path taken by television signals, and the normal curvature of the earth, which limits the direct wave according to the height of the aerials.

IT is true that reception can often be obtained beyond visual range according to local conditions and transmitter power, but for a reliable planned service this visual limit must be taken as a basis for assessing usable range.

Because the horizon extends appreciably as the height of the transmitting aerial is increased, most television sites are erected as high as possible. The new British station at Sutton Coldfield has an above-sea level height of about 1300ft, which, together with its high power and high gain aerial, gives excellent range.

In America many of New York's skyscrapers are graced with television aerials to make the most of their great height.

To increase the service area of a television station it is possible to relay the programmes either by direct radio link over skips of a few miles or by co-axial cables, and to broadcast them through auxiliary stations. This is an awkward and very costly process at best, and steps up problems of maintenance to serious levels. It also introduces many new technical problems, requires ether space for the relay stations, or, as in the case of the cable, pushes up cost to astronomical figures.

It is natural, therefore, that engineers should begin to investigate the simplest of all means to increase range—that of adding height to the transmitting aerial.

MAST PROBLEMS

There is, of course, a limit to the height of ground-based aerials. To effect a really worthwhile increase in service area by this means masts would soar many thousands of feet. Mechanical considerations would rule them out, and the danger to air traffic would be great.

Stratovision has been advanced as a possible solution. Briefly, it consists of housing the entire televisi transmitter and aerial in an aircra and sending the whole outfit hi into the sky—as high, in fact, flying considerations would allow. relay radio link sends the programm from studios to aircraft for tran mission on regular channels.

The increase in range made po sible by this method can be visualis by anyone who has flown at a gre height in an aircraft. It far outstri anything which can be achieved fro the highest single aerial on t ground.

First reactions to the idea were rule it out as fantastic, but tod engineers aren't so sure. The resu achieved by keen experimenters w have spent much time and money the idea have made many of us thi again.

The experiments, we learn, ha now been discontinued, but ma believe that some form of airbo television is the only answer to coverage of city and country areas. They stress among other things that repeater stations and cables must be planned with local geography in mind, but a high-flying aircraft can span mountainous or difficult country just as easily as the open sea and wide rivers.

INCREASED RANGE

Some idea of what this range might be, as opposed to the 50-mile range of a very good ground installation and up to, say, 100 miles under most exceptional cases, the horizon range of a stratovision plane flying at 30,000 feet is about 210 miles. Usable reception should still be possible beyond this primary limit, with a considerable addition where the receiving station is located on high ground.

The transmitter power needed to achieve such results is comparable with that in normal use.

There are certain reception characteristics normal to stratovision which will probably cause areas of reduced signal strength to occur within the service area. These are due to a number of causes, all of which can be traced to the peculiar field pattern of the aerial used on the plane and its relation to the earth. This radiation pattern is not uniform at all angles to the earth but is rather made up of a number of "lobes" between which there may be points of comparatively low signal strength.

REFLECTIONS

These lobes, combined with the effects of reflections from the earth or nearby objects, will cause signal strength variations to occur throughout the service area, the severity of which varyies according to the actual hight of the aircraft and the transmitting frequency used. At some points direct and reflected waves will add, and at others subtract. There are as many nulls or points of low field strength between the transmitter and its effective horizon as there are half-wavelengths between the aircraft and the ground, which means, of course, that the very high frequencies (low wavelengths) will cause a greater number of nulls.

This effect can largely be reduced by varying the height above ground of the receiving aerial, experience showing that best results are often obtained with aerials quite close to the ground. Again, this effect is more noticeable on the higher frequencies, where problems of "shadow," reflection and attentuation become more severe.

Some of the first stratovision experiments were carried out by the Westinghouse and the Glenn Martin companies, using a twin-enginer PV-2 aircraft fitted with a 250-watt transmitter on 107.5 mc and a pulsed transmitter of 5 kw peak on 514 mc.

Results showed that theoretical calculations were, in the main, borne out in practice, provided that the receiving conditions were in positions such that the true spherical nature of the earth prevailed. The normal "shadow" effect of hills was present, but in most cases the minimum values of signal strength were not as low as calculations would indicate.

Encouraged by these results, a larger aircraft was obtained—actually a Superfortress — capable of carrying a complete equipment of higher power. Its weight required removal of all military armament and the installation of three 15 kva 500 cycle alternators coupled to the engines.

PROCEDURE

The cabin was pressurised for operation at 30,000ft. The procedure was to use the period of initial climb for setting up the equipment, after which test paths were flown in order to tabulate results.

The aircraft was fitted with standard receivers capable of picking up existing commercial television stations, as well as a special link on 547.5 mc for relaying the programme to the aircraft for rebroadcast. 5 kw video transmitter and a 1 k sound transmitter were include operating in the television ban (channel 6-82 to 88 mc) togethe with its monitoring and contro panels. Two other transmitters o 250 and 750 mc were carried, each o 200 watts for CW, and a 50 kw peak pulse transmitter operating on the extremely high frequency of 3300 mc

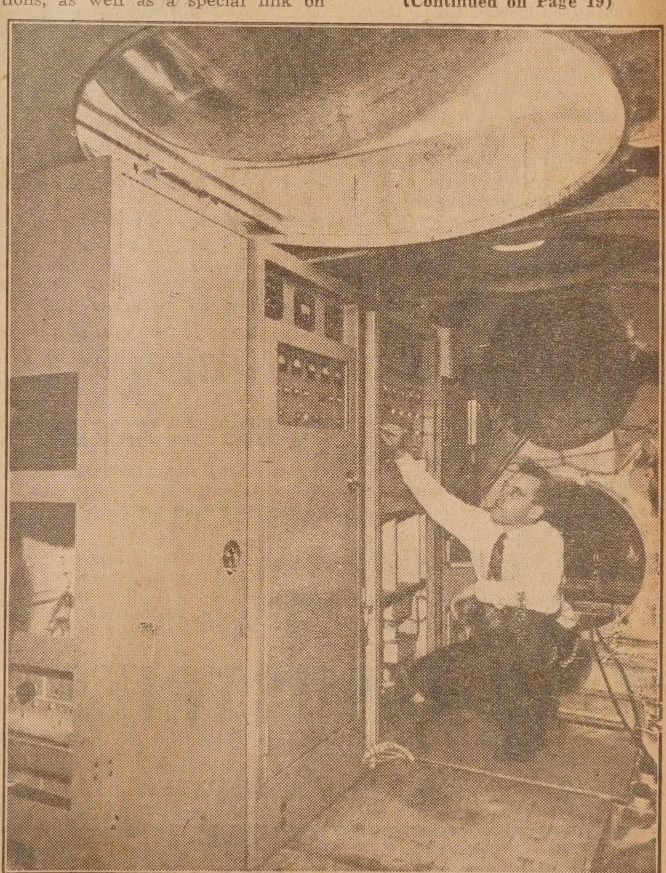
AERIAL SYSTEMS

For reception an eight-foot streamlined mast was mounted on the vertical tail fin as being the spot mos isolated from the transmitting array On the mast were mounted circular receiving dipoles.

For transmission a retractable mas was mounted under the fuselage so that in operation it extended downwards. To it were fitted a two element turnstile array for channel 6 video, a single element dipole for sound, and a 547.5 mc relay link. Despite streamlining of this array, the extra drag imposed was equivalent to some 600 hp.

Air-conditioning was found to be absolutely necessary for the operation of the equipment in so small a space, for despite the fact that the outer air was only 25 degrees the

(Continued on Page 19)



All Stratovision airborne television and frequency modulation equipment was built to conform to contours of the aeroplane, and each section had to be brought in through the 48-inch hatch (top centre). Frank G. Mullins, Westinghouse Electric Corporation engineer, adjusts the 1000-watt transmitter which had to be built in two sections mounted side by side. The photograph taken during modification of cabin (forward) and shows the compartment at the left which houses receivers, power supply and monitoring amplifiers.

YOU NEED A TWO SPEED

New-Type B.R.S. Super-Silent Gramophone Turntable

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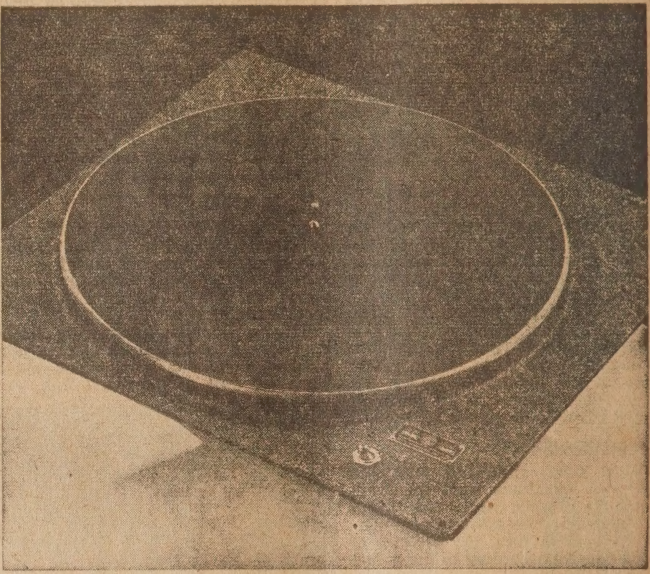

Standard turntables, mass-produced for domestic use, can rarely do the job that enthusiastic record fans demand. In view of this, Byer Industries have developed "T25", a professional type turntable for amateur use, available with or without pick-up. The T25 will rotate at constant speed. Because of this, the "wow", "flutter", and "rumble" noises so often found in ordinary turntables have been completely eliminated. The wide margin of reserve power of the motor, and the inertia of the cast turntable overcome the common tendency to slowing down on the heavier passages and more violent transients. The motor, mounted on floating buffers, is synchronous and gives constant correct speed, at either 78 or 33⅓ R.P.M. This means that when the new Microgroove discs arrive in this country, T25 will be the ideal turntable. These features combined with the close tolerances held throughout manufacture ensure silent, efficient operation, as well as long service life.

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If you want a turntable and pick-up that's better than "run of the mill" equipment, you must have a new Super Silent B.R.S. Unit. Write direct or call on the Manufacturers, or your local State representative. A T25 unit will make your listening more enjoyable whatever the records.

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FOUR MILLION T. V. RECEIVERS

Says F. C. C. Chairman

The fabulous growth of television in America has just begun, according to the government official who is charged with supervision of this sprouting industry. In a recent interview, Wayne Coy, chairman of the Federal Communication Commission, reviewed television progress to date and predicted likely developments in the television-radio family.

THUMBING back over a story that had its beginnings only since World War II, Coy noted these statistical achievements:—

From an estimated 10,000 television sets in existence on V-J Day, the nation now has and is using more than 4,000,000 receivers;

The handful of experimental TV stations of 1947 has swollen to 98 full-fledged TV transmitters in 57 communities, a total that will increase to 108 when establishments now under construction are completed;

The infant industry has grown, primarily in specific metropolitan areas, to the point where 25,000,000 of the nation's 37,280,000 families will, by midyear, be within the reception range of a going TV station, and,

Within the geographic areas now served by television, one out of every four families has a television set.

"I do not suppose," Coy said, "that there has ever been so startling and unpredictable a growth in any new industry in so short a time."

Running through a reporter's quiz list, the FCC chairman picked up the question as to whether TV will continue its beanstalk soaring.

"I see nothing at all to indicate that it will not," Coy replied. "The generally accepted prediction is that the 4,000,000 receivers of today will become 8,000,000 by the end of 1950. That would certainly seem to bear out the industry's prediction of 18,000,000 TV sets in another four years."

SET SALES

Coy noted as "particularly significant," the officially reported television set sales in this city during January.

"During the month," he said, "Washington merchants sold 10,100 sets, an average of 500 a day for each business day. The month before was the biggest television sale month in the city's history, and January was the second biggest.

"Several factors, of course, entered the picture. One was that merchants had been unable to fill all their Christmas demand, and many of the January deliveries were actually December orders.

"But, on the other side of the picture, there is the fact that this phenomenal January record was set at a time when Washington was the focal point of the bitter argument over transition to color telecasts. The Columbia Broadcasting System was running full-page newspaper advertisements urging Washingtonians to come and see their color demonstration. Despite this uncertainty-breeding situation, people flocked in to buy."

EFFECT ON RADIO

"Will television ultimately supplant radio?" Coy says this question cannot be answered "yes" or "no."

"It is a relative proposition," he declared. "Television has already become a great night-time medium of entertainment. It is estimated that there are 81,000,000 radios in operation, and that 95 per cent of the nation's homes have at least one set. But unquestionably the big new television audience has come from radio, and the radio loss will be greater as we approach a saturation point of TV installations.

"On the other hand, there is the fact that television does not have the daytime attraction of radio. With TV you have to stop and look in order to listen. With radio you can listen and work too.

"My theory is that radio can partly combat the drain of its listeners by better programming. Certain programs, specifically news and music, are as good or better on radio than on television. Also, there are certain areas where television development must inevitably be slow.

"My best guess is that, although TV will become the major vehicle, radio will serve a long and continuing function."

From our U.S. Correspondent

Has television presented the FCC with any regulatory problems not experienced with radio?

"Not yet, but maybe soon," was Coy's reply.

"A problem may be developing," he explained. "Television is a far more intimate home visitor than radio ever was. Already we are seeing evidence of growing parent concern over the type of programme being produced in some areas."

Coy recalled a recent letter from a Southern California group which had systematically monitored Los Angeles stations for a week. They reported a specific list of programmes which included 91 murders, seven stage holdups, three kidnappings, 10 thefts, four burglaries, two cases of arson, two gaol breaks, two suicides, several portrayals of dishonest judges and juries, "and more cases of assault and battery than could be tabulated."

RESPONSIBILITIES

"Right now," the FCC chairman said, "that whole situation is in the hand of the broadcasters. If they recognise the problem, the need for tighter regulation may be obviated. To the extent that TV may ignore the needs and feelings of the community, its problems may be serious."

Coy believes that "by the fall of 1952," the West Coast will be hooked into the spreading cable-relay station network which has already stretched from Boston south to Philadelphia, New York, Baltimore, Washington and Richmond, and west to Pittsburgh, Buffalo, Cleveland, Toledo, Detroit, Chicago, Milwaukee and St. Louis.

"At the same time," he went on, "several other developments may take place. Just recently a Bridgeport, Connecticut, "satellite" station went into operation to pick up the

(Continued on Page 85)

2 NEW PALEC STARS

PALEC M.30 MULTIMETER

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Decibels (a) Zero reference level = 6 milliwatts in 600 ohms: —17 to +3: +3 to +23: +23 to +43.
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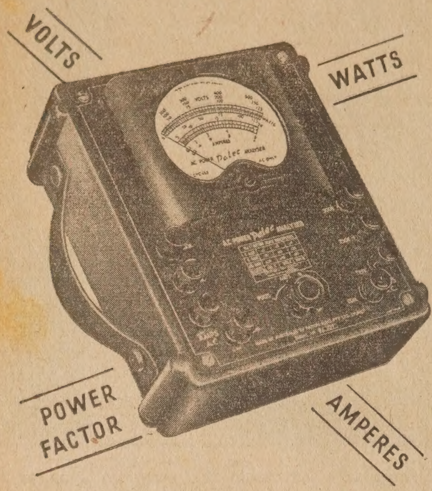

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The Palec A.C. Power Analyser incorporates a true dynamometer movement of the nickel-iron cored type. There are no rectifiers or non-linear resistances included, nor is it necessary to compensate for line voltage in wattmeter readings.

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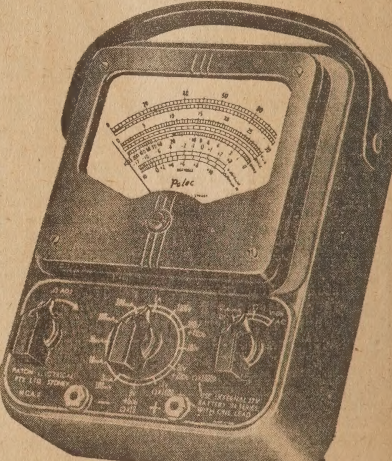
DIMENSIONS: The Palec Power Analyser is housed in an exclusive semi-hard rubber case, size 8 inches by 9¼ inches by 4½ inches overall. Weight, 8 lbs.

Price: £23/15/- plus tax.

M.30 MULTIMETER



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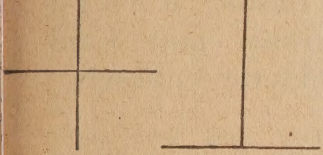
YOU CAN'T BELIEVE ALL YOU SEE

By Prof. A. M. LOW

It has often been said that the human body is a mass of imperfections, due to the way we have tried to adapt ourselves to civilisation, as a part of the process of Nature. This is certainly true of the human eye which, at the one time, is a miracle of accomplishment and a classic example of compromise.

CHILDREN are very commonly damaged in regard to the focusing of their eyes by straining to see objects when the muscular and other systems of the eyeball are not properly formed. It is well known that certain professions, such as that of the old-fashioned cobbler, tend to a peculiar enlargement of the thumb joints, while the whole of our internal economy is a mass of examples of compromise.


Figs. 1 and 3. A simple test with horizontal and vertical lines.

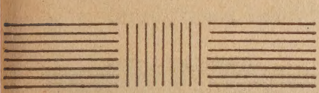


Fig. 2. Test for astigmatism.

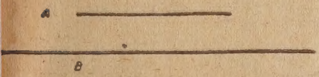


Fig. 4. Does line B look twice as long as Line A?

One of the most striking and easily established examples of this circumstance is afforded by the eye, which as a miracle of accomplishment is beyond all human appreciation, but which as an optical instrument is so faulty that no manufacturer worthy of the name would dare to put it upon the market.

SYSTEM OF LENSES

In brief, they eye sees by the focusing of an image or any view through a system of lenses on the retina or sensitive portion. This part is composed of myriads of mocroscopic portions set together in the fashion of a mosaic brick, each of which communicates with the brain by its own nerve.

The eye is sensitive to color on account of one set of sensitive slots comparing to the cement in which each mosaic stone is set and to "form" by virtue of the pieces from which the pattern of such a mosaic would be composed.

A number of minor defects occur in every eye, some of the lenses may be incorrectly formed and, in fact, are not round in the usual sense at all. One has only to look at a star or to look through a pinhole in a sheet of cardboard to notice that rays seem to spread out in all directions.

This is simply on account of the piecing together of the lens during its formation, and in the eye of a young child this building up is so poor that there are often clumsy sutures of this nature.

Even this little experiment with the card illustrates another fault of the eye, that of irregular astigmatism. The lenses of the eye are not curved identically in the horizontal and vertical directions so that these images are shaped and focused in different fashion for each eye. (Fig. 1.)

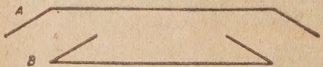


Fig. 5. Which line looks longer?

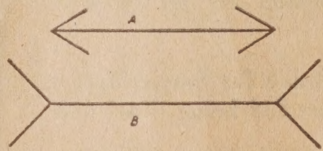


Fig. 6. A similar test to Fig. 5.

A more astounding fault leading to many illusions of vision is that of chromatic aberration. The defect seems all the more extraordinary when it is realised how easily it might have been avoided during the designing of an eye. To produce a combination of lenses which was achromatic would seem to be perfectly simple, for it is invariably adopted by every instrument maker worthy of the name.

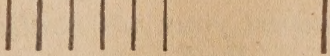


Fig. 7. A question of spacing.

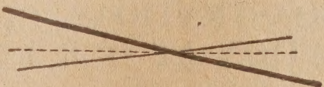


Fig. 8. Imaginary horizon.

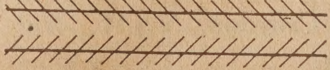


Figure 9. Diagram demonstrating the illusion of altered gradients.

CHROMATIC ABERRATION

The point is not difficult to illustrate for if a simple lens or burning glass is used to focus a red light upon a piece of white paper a clear image will be produced in the ordinary fashion. Substitute violet colored light and it is at once discovered that the paper upon which the image rests has to be moved in order to secure sharpness.

Violet light is more easily refracted or bent by the lens than the red, so that it is not practicable properly to focus an image when the source of illumination is composed of a number of different colors of the spectrum.

No single lens used with daylight can be made to give a perfectly distinct image at all, yet this feature of the eye becomes forgotten by nature's accommodating provision of a brain to meet the case. The very idea of distance to which our eyes form the necessary focus is always associated with certain colors.

Nearly everyone will consider that a room seems far larger when painted a blue violet rather than

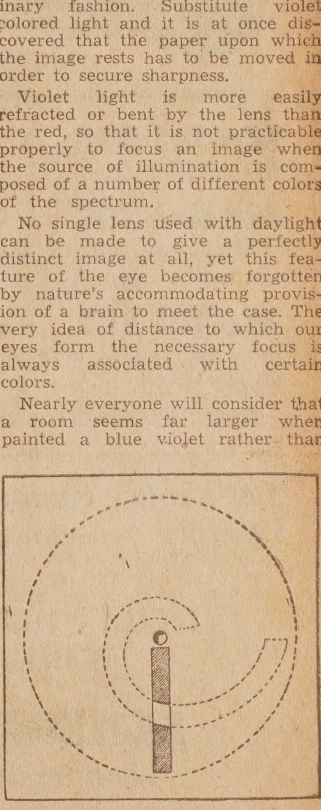


Fig. 10. Simple device for demonstrating how the eye forms a standard of speed.

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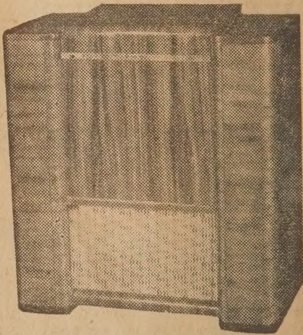

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a red, while a red spot upon a blue ground appears to be distinctly proud of the surface for the same reason. Anyone looking at a red object has to adjust the crystalline lens of the eye by muscular effort, but for a blue or violet object the muscles are relaxed and the curvature of the eye reduced as if the onlooker were looking towards the horizon.

We all attempt to estimate distance, but the amount of effort needed to produce the muscular focusing varies so that this has caused red to be associated in our minds with a foreground and violet with something which is far away.

To look at the filament of an electric bulb through a piece of ordinary blue cobalt glass is to cut out the middle of the ordinary spectrum. From a distance of a few inches the filament seems to be pale blue, but at 6 or 8ft away the light filament looks distinctly red.

Probably the commonest of all optical effects due to our faulty eyes is that of the blind spot and of the manner in which the portion of the sensitive retina immediately behind the centre of the eye seems more sensitive to color than to form.

If you will make a spot and a circle upon a piece of paper about 2½ inches apart it is found that when fixing the eyes upon the circle and bringing the paper slowly towards the face the spot forms an image which falls on the point where the main bundle of optical nerves enters the eye and connects with the recording system. This place is entirely insensitive, so that no image can be sent to the brain.

Fig. 11. Test for estimating the rate at which a card is moved.

Looking at a clock in a dimly lit room, the time is much more easily seen by directing the gaze a few inches to either side of the timepiece, when the modest amount of light available for vision falls upon a more sensitive part of the retina than would otherwise be available. This is quite useful in everyday life as a means of finding door handles or keyholes.

The difficulties of astigmatism due to the irregular shape of the eye, which is often more like the bowl of a spoon than spherical, leads to the case when vertical and horizontal lines are seen with quite different degrees of distinction. (Fig. 2.) If this experiment is repeated by looking at a small spot of red light, a concave lens will cause this spot to appear as a number of small bright round spots upon a dual background.

This is another type of fault probably due to some complicated structure in the eye near the crystalline lens itself. There are a number of optical illusions which really depend upon the association of the mind with the faulty images of the eye in accordance with habits or custom.

We are used to thinking that a monument with a large base must have a high tower upon it and, to give another example, when we have looked at something which is extraordinarily big, our mental standard of size is educationally altered.

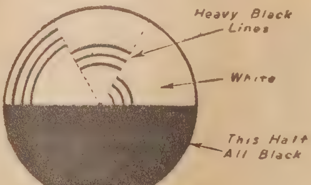

Fig. 14. The spinning disc illusion.

If, as in Fig. 3, two lines are drawn, one upon the other, of equal length, the mind doubtedly sees that the vertical is the longer of the two, and if this comparison is made relative to two objects in proximity, but differing in size, there is a distinct attempt on the part of the brain to co-ordinate the size.

In Fig. 4 the lower line is twice as long as the upper although, the difference certainly does not seem nearly so much. This effect is well known to those who have toured in mountainous country and discovered that beyond a certain size of hill dimensions are rather disappointing.

It is very easy by means of Fig. 5 to suggest that the line A is much longer than B, merely by varying the subconscious standard which is applied in this test. If two more strokes are added to each line, as in Fig. 6, the variation of mental impression is even more pronounced.

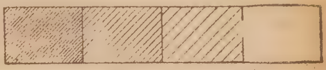

Fig. 12. Test for estimating brightness.

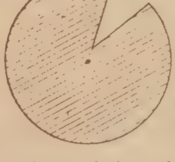

Fig. 13. Another simple colour test.

Looking casually at Fig. 7 it would hardly be suggested that the space between the extreme lines was not equally divided by the middle line, for the left-hand portion at a casual glance seems far longer. There is a further experiment, when an individual is asked to mark from the floor the height of an average top-hat. The point is usually made far too high, due to the estimation taking place relative to something smaller than a room.

Nearly every hill is referred to in terms of its position relative to the

(Continued on Page 101)

500-MILE JOURNEY IN SPACE

A nearly intact tail section of a "Wac Corporal" rocket that reached an altitude of 250 miles has been recovered at the White Sands, N. Mexico proving grounds—the first ever to be recovered. Mrs. Dolores Mohlmann of Schnectady holds an electrical switchette and model of two-stage rocket in which it made its epic journey.

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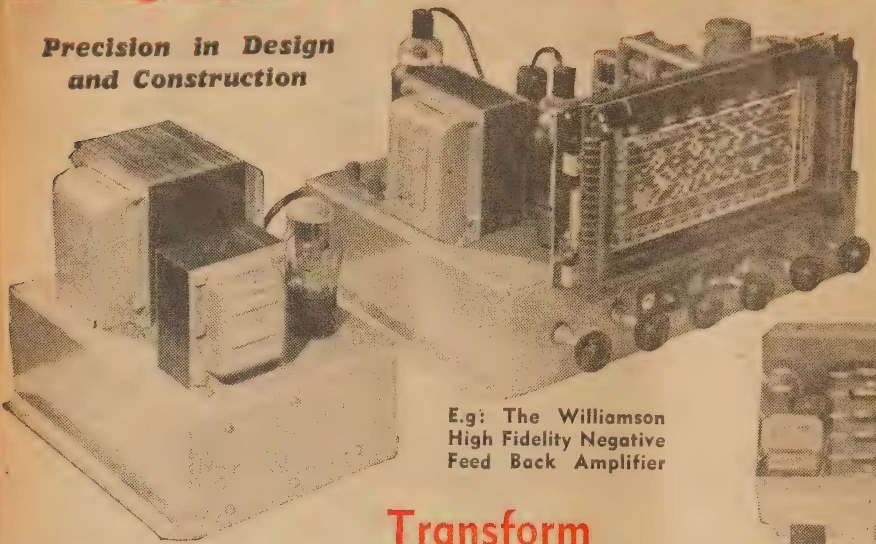

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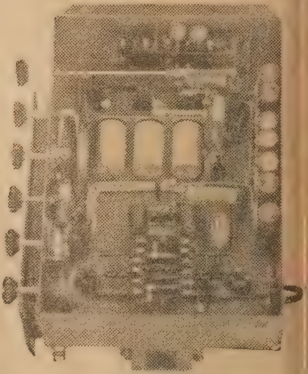

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Wind tunnels—prime tools in aerodynamic research — have been in regular use ever since the Wright Brothers built their first man-carrying aeroplane. Nowadays, they are used to test planes, engines and missiles at air speeds up to ten times the velocity of sound.

THE Wright Brothers' tunnel was a primitive device compared with those now in use, but it can be rightly called the forerunner of all American wind tunnels.

Though described originally as nothing more nor less than a long square tube with a glass cover, it contained the approved devices to break up eddies and give a smooth flow of air along its length. Simple instruments were devised to measure air resistance, lift, and so on.

SIMPLE MACHINERY

The air pressure was created by an ordinary set of fan blades mounted on a bench grinder, and driven from the shop line shafting.

The Wright Brothers soon found that the air flow through the tunnel followed a circulating pattern, which gave entirely false values to their measurements. Accordingly, they provided four cross baffles, a hundred odd square holes and several wire screens. After all this, they were left with a reasonably smooth 7 mph breeze.

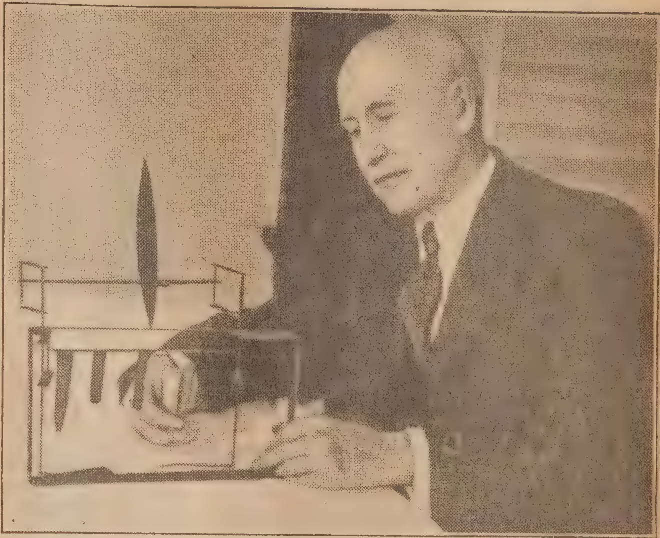
By contrast, modern aircraft research has warranted the construction of special tunnels which pass air at thousands of miles per hour and several times the speed of sound. A German suction tunnel captured intact by the US Armed Forces, recorded an air flow of 3960 mph.

Even faster than this, however, is a new tunnel recently put into service at the Californian Institute of Technology. Intended to facilitate study of inter-Continental missiles, it can unleash a man-made tornado with an extreme speed of ten times the velocity of sound—about 7500 mph.

ALL SIZES

Modern wind tunnels vary from miniatures used for laboratory model tests to giant structures over a hundred feet long, capable of testing full-size aircraft parts. In some, the air flows horizontally; in others, vertically, according to the type of test required. In some tunnels, the air circulates continuously; in others, it is used only once.

Shells, rockets and bombs all go through their paces in wind tunnels, and the recent development of jet engines of varying types has further underlined the value of these man-made tornadoes. Engineers have been able to study the performance of the engine at varying speeds and atmospheric conditions without ever taking it off the test block.

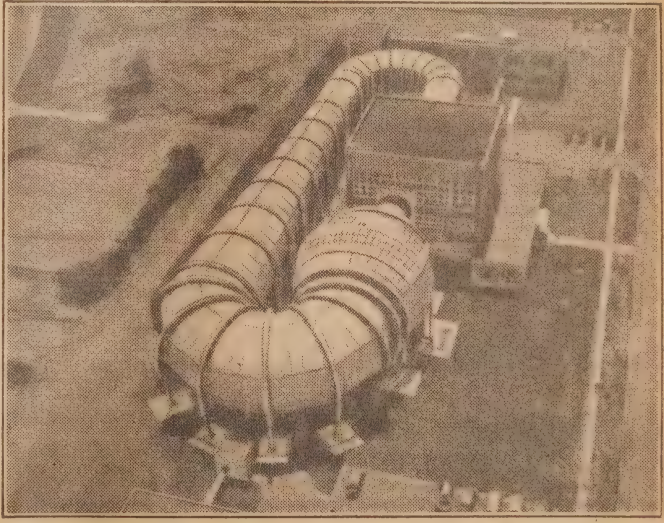


A relic from the not-so-distant past. The late Orville Wright examines an early measuring gauge used by himself and his famous brother.

Instruments have been designed to register every detail of behavior, while motion picture film is often employed to provide a permanent record. Scientists have even devised means of rendering air movements visible so that currents, eddies and turbulences can be observed and photographed directly.

Horizontal tunnels follow the same general pattern. A fan or turbine compressor drives air into the tunnel throat, after which the cross section gradually increases until the air is flowing at high speed through the test chamber. In some cases, the air is simply extended in the atmosphere, while in others, it flows through a

(Continued on Page 83)



Typical of modern wind tunnels is this NACA installation at Moffett Field, California.

Every gardener uses the pruning shears each year to improve garden productivity but few know that it is their regulation of hormone supply which really does the trick. How this comes about is told in our Calvin Walters article.

picture. A man comes now and again with a motor mower. Of course, I avoid telling others about that so that I can enjoy the compliments meted out to me about my lovely lawn and how hard I must work to keep it like that. I even know all the different things one puts on a lawn to make it greener. In that way I can be a fund of information to the seeker.

As for searching for snails at night with a box of matches, that I consider is the last thing. You catch a tin full of the things and then go back an hour after to start all over again. They sneak up behind you and wolf all the plants before you can turn round.

SALTING TAILS

It is a tiresome business, too, waiting for the slimy things to stick their tails out so you can put salt on them.

If possible, I encourage the neighbors to plant their dahlias or roses as close to my fence as possible. Then people going by think they are growing in my place. Any that come through the fence, of course, are my property. I found out about that. If the neighbor complains about my taking them I can sue him for allowing his flowers to trespass.

The best plant I know of is the nasturtium. It has lovely flowers. It grows without attention. You can eat the leaves and pickle the seeds in vinegar. When visitors come you pass the seeds off as capers on roast beef.

SECRETS OF PLANT GROWTH

Not since the discovery of artificial fertilisers has the agricultural world experienced such a revolution as has been brought about by the discovery of plant hormones.

WHEN it was found many years ago that certain chemicals were necessary for plant growth, it led to the manufacture of artificial fertilisers. This was a great step forward in agriculture, for it meant that soils exhausted by continual use, or naturally barren by reason of the lack of the necessary chemicals, could be brought into a condition of fertility by the application of this new-found knowledge.

Another great advance was the artificial production of new varieties of plants.

This process can create new kinds of disease-resisting and high-yielding plants. New fruits can be evolved. Hybridisation can give larger and better flowers and new kinds altogether.

The new era of plant hormones is a much greater advance than anything heretofore.

I love a garden. Almost everyone loves a garden. That is an entirely different thing from loving gardening.

I enjoy watching people digging the same weeds out every weekend or mowing the lawn. It gives me great pleasure to see people taking a pride in their front garden.

What I can't understand, though, is how they manage to keep the nails and pieces of old wire out of the mower blades. My own lawn is a

We seem to have digressed a bit so we will get back to our hormones.

These are also termed "auxins" and are chemical substances, produced in one part of the plant and transferred to another part. They regulate growth, sometimes accelerating it, and at other times retarding it.

The seeding of grasses is mostly used to illustrate the effects of auxins on the growth of the plant.

When a grass seed begins to sprout, the young shoot is at first covered by a thin sheath called the celeoptile. This protects the young bud during its excursion into the open air.

As growth takes place below this

sheath, the bud is, so to speak, pushed up through the ground.

This growth appears to depend on the production of an auxin at the tip of the celeoptile.

Cutting the tip of the celeoptile from the shoot results in a cessation of growth, but if this tip is kept alive and put back again the growth of the shoot is resumed.

The fact that something is produced in the tip of the celeoptile is borne out by a simple experiment.

If the severed tip is placed for some time on a block of gelatine, and this gelatine is then applied to the cut off top of the young shoot, growth begins to take place.

When the young shoot has reached the surface of the ground the growth slows down or stops. It appears from this that light has some action in retarding the production of this particular auxin.

HORMONE EXTRACTION

We will now begin to refer to these auxins as hormones because it is the commonly accepted term. They were called plant hormones because their action seems to be very similar to the hormones known to be present in the bodies of animal life.

Hormones are sometimes extracted from plants by maceration. The extract can then be applied to the organs of plants which are capable of growth and the results tabulated.

Many of these hormones have been analysed and their chemical structure determined. They are very complex organic acids. These are some of them:—Indolebutyric acid, Naphthaleneacetic acid, Dichlorophenooxyacetic acid, Naphthoxyacetic acid, Phenylacetic acid, Indolepropionic acid, Trichlorophenoxyproprionic acid.

That is enough for the time being. Any student of chemistry can see from the names how complicated they are chemically.

A remarkable thing to note is the extent to which acetic acid occurs in the composition of hormones.

About thirty of these hormones are now made synthetically, so that they can be used in agriculture to do many funny things to plants. Some of these will be dealt with later.

Not much is known of the reason why hormones act as they do. What complicates things a bit is that one hormone will perhaps retard growth in a particular part of a plant and accelerate it in another part. It may also increase growth when applied in one particular strength and retard it when applied in another strength.

GUESSWORK

It seems at present that our knowledge of why hormones act as they do is more or less guesswork.

It has been suggested that a hormone has the ability to allow or prevent the walls of plant cells to stretch.

This would naturally allow or prevent growth.

Some observers think that the hormone acts as a regulator to the absorption of water by the plant cells. Others believe that they exert an influence on the enzymes present in the cells, stimulating them to action or retarding them.

It is known that the buds on upright shoots of plants produce a hormone which affects the growth of the flower. Everyone knows that if the terminal bud of a plant is removed the other buds will develop into better and bigger flowers. This is because the terminal bud takes precedence over the others until the hormone produced in this bud is removed, thus stimulating the growth of the other buds.

This is particularly exemplified in the potato plant. The potato has several "eyes." All these are capable of shooting and growing into a potato plant.

If, however, the whole potato is planted only the terminal bud will usually grow. But if the potato is cut into several pieces, each having an "eye," all these will grow into a plant. It appears from this that the terminal bud produces a hormone which has the effect of retarding the growth of the other buds unless destroyed or separated.

by Calvin Walters

Liquid manure applied to plant cuttings to induce growth appears to have a greater function than the supply of nourishment, because these manures are known to contain chemicals which accelerate or promote the growth of plants.

Synthetically - produced hormones are usually applied to the surface of the plants by mixing with talcum powder and dusting the plant with it, or as a spray mixed with water or perhaps alcohol, although many will consider the latter a wicked waste of a purely medicinal beverage.

CARE NEEDED

Considerable care must be exercised in the application of the hormone, for unless applied in the correct concentration and in the right place, abnormal effects may be brought about in the plant.

For instance, there is a hormone which encourages fruit set in tomatoes. If this is sprayed over the whole plant, the leaves will distort. If, however, the spray is applied to the flower only, the desired effect will be produced without distortion of the leaves.

As an illustration of the extremely small amount of hormone required to effect a plant, it is recommended by makers of hormones that the spray previously used for hormones should be washed in several changes of water before using it for the application of fungicides, as any residue of hormone in the spray might result in injury to the plants.

As regards some of the things which the application of hormones will accomplish, mention might be made firstly of the necessary thinning of blossoms, which apple-growers carry out at times.

Heavy-cropping varieties of apples require to have the blossoms thinned out in order to create better fruit. This has hitherto been done by hand —a most laborious process.

Certain chemicals have been discovered which will accomplish this merely by spraying on to the trees. Experimental work with this is still going on and a perfected method is awaited.

Premature dropping of fruit is one of the orchardist's big problems. There are now hormone sprays which prevent this. Naphthaleneacetic acid and naphthaleneacetamide are two of them. Different hormones must be used for various varieties of fruit.

POLLINATION

Most fruits will not bear fruit unless correct pollination has taken place. This usually depends on the work of bees and other insects. This matter is particularly important to those who produce tomatoes in glasshouses. Hormones are now used to produce the effects of pollination as required merely by the application of the chemical to the plant.

It has also been found that certain hormones will produce seedless fruit, and much experimental work is now going on. Who wouldn't like a seedless mango? Or seedless raspberry jam? Seedless peanuts wouldn't have a great appeal except to picture-theatre proprietors. Skinless bananas would be a great idea.

Hormones are now used to treat seeds so that the chemical will be available to the young plant when germination takes place.

A well-known application of hormones lies in the killing of weeds. Wide use is made of a hormone called 2, 4-dichlorophenoxyacetic acid. This is commonly known as simply 2, 4-D.

This hormone is sprayed on the leaves of woody plants and broad-leaved weeds. It is thus particularly valuable for application to lawns, as it kills such weeds as dock weed, dandelion, &c., without harming the narrow-leaved grasses.

TOP DRESSING

It has been used as a mixture in top-dressing for lawns and bowling greens. This prevents germination of undesirable weeds.

Most people who garden are intensely interested in anything which kills weeds. It is a singular thing that snails and slugs will not accomplish this. But hormones will, although great care must be exercised so that the hormone spray is confined to the area under control.

Hormones are used to break dormancy in various plants and trees. By this is meant that plants rest at certain periods of the year, such as the autumn. Sometimes the conditions necessary for the plant to

(Continued on Page 21)

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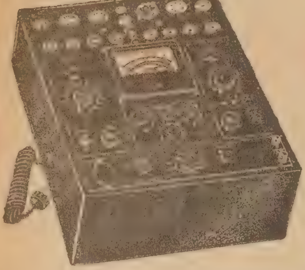

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0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+4 to +29	
0—250	0—250	0—5 Amps	+18 to +43	*With external battery.
0—1000	0—1000		+30 to +55	

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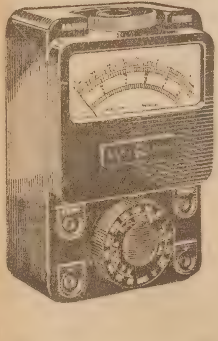

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Technical Review

OLD-TIME CIRCUIT USES NEW CRYSTAL TRANSISTORS

The transistor, a crystal device which can amplify, has made quite an impression overseas, and many new uses have been found for it. Here we have an old time circuit presented with new time crystals, and no filament battery. As far as is known transistors are not normally available in this country.

THE introduction of the new CK-703 crystal triode opens up a new field of interest for the radio experimenter. Recommended for use at frequencies up to the video range, this commercial transistor can be used as a medium mu AF or RF amplifier, oscillator, or control "tube." Simple, small-sized, and lightweight electronic equipment may be built around crystal triodes.

A simple crystal diode broadcast receiver with a crystal triode audio amplifier will not operate a loudspeaker, but it will give a walloping good signal in high-impedance headphones, provided it is connected to a good outside antenna and ground.

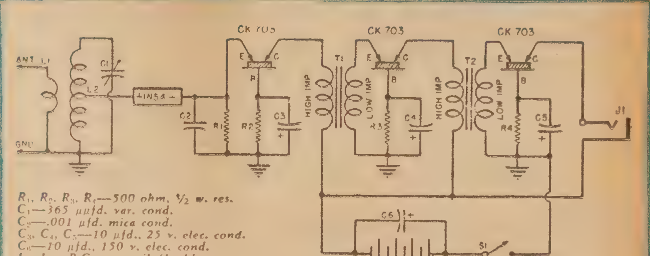
FEATURES OF TRANSISTORS

The transistor is a germanium crystal device. It differs from the familiar crystal diode, of which the 1N34 is a well known example, chiefly in that the transistor has two catwhiskers instead of one.

One whisker, called the emitter, acts in a manner comparable to the grid of a triode vacuum tube. The point of the second whisker, called the collector, touches the surface of the germanium crystal extremely close to the place of contact of the first whisker and acts like the plate of a triode tube.

The crystal itself (called the base in crystal triode terminology) is comparable to the cathode of a tube. Unlike a tube, however, the emitter (grid) of the crystal triode is biased with a low positive voltage, while the collector (plate) receives a high negative voltage.

Another important difference is that the crystal triode has a low-impedance input and a high-impedance output. The recommended circuit symbol for the transistor is shown in Fig. 5A.



R_1, R_2, R_3, R_4—500 ohm, ½ w. res.
C_1—365 μμfd. var. cond.
C_2—.001 μfd. mica cond.
C_3, C_4, C_5—10 μfd., 25 v. elec. cond.
C_6—10 μfd., 150 v. elec. cond.
L_1, L_2—B.C. ant. coil (builder must center tap sec. L_2) (J.W. Miller 20-A)
J_1—Single-circuit insulated phone jack
S_1—S.p.s.t. toggle sw.
T_1, T_2—Miniature matching trans., 3/1 ratio (U.T.C. SO-2)

1—1N54 crystal rectifier
3—CK-703 transistor amplifiers
1—45 v. "B" battery

Complete circuit diagram and parts list for the crystal-transistor receiver. A 1N54 rectifier is used as a detector.

The CK-703 is a small-sized unit, being only 0.78 inch (maximum) long and 0.255 inch in diameter. The housing of the CK-703 is a cylindrical brass shell to which the crystal is connected internally.

This shell serves as the base (cathode) terminal. The emitter and collector whiskers are connected to two nickel contact pins which extend through an insulating disc-plug in one end of the brass shell.

TYPICAL OPERATION	
Emitter Voltage	0.2 v.
Emitter Current	0.75 ma.
Collector Voltage	—30 v.
Collector Current	2.0 ma.
Transconductance	5000 micromhos
Emitter Impedance	500 ohms
Collector Impedance	10,000 ohms
Average Power Output	2 milliwatts
Average Power Gain	16 db.
MAXIMUM RATINGS	
Collector Voltage	—70 v.
Collector Current	4.0 ma.
Collector Dissipation	200 milliwatts
Emitter Current	10 ma.

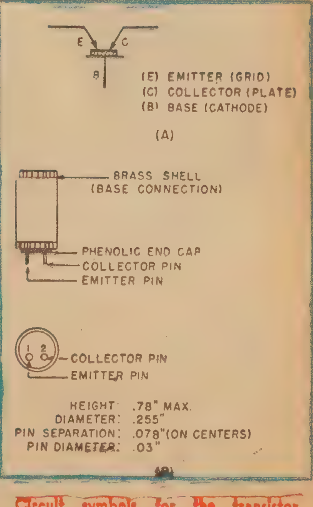
Table 1. Electrical characteristics of CK-703.

IMPEDANCES

The CK-703 has an input (emitter) impedance of 500 ohms and output (collector) impedance of 10,000 ohms. It is rated at two milliwatts average power output with an average power gain of 16 db. The power rating is on the basis of a 50-microwatt signal applied to the emitter. Table 1 gives the important electrical characteristics of the CK-703.

From the impedance ratings, it is evident that a conventional amplifier circuit employing crystal triodes must provide for an impedance step-down between stages. This means that interstage transformers must have a step-down turns ratio.

—Radio News.



Circuit symbols for the transistor. Details of CK-703 crystal triod

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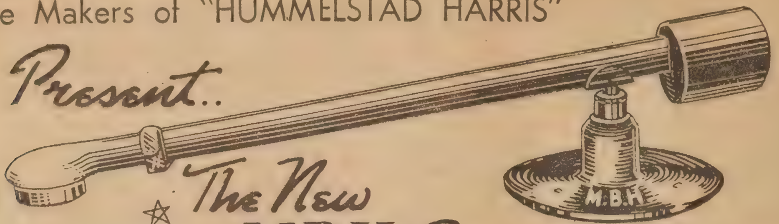

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VHF antennae present a major problem particularly for television and FM work where reception and transmission are required over a wide band of frequencies. Constant attention is paid, therefore, to the evolution of simple designs which will produce the desired results. This aerial appears to succeed on all points, and although no gain figures are given, should prove most effective. Various constructional details are applicable in principle to other types of aerials.

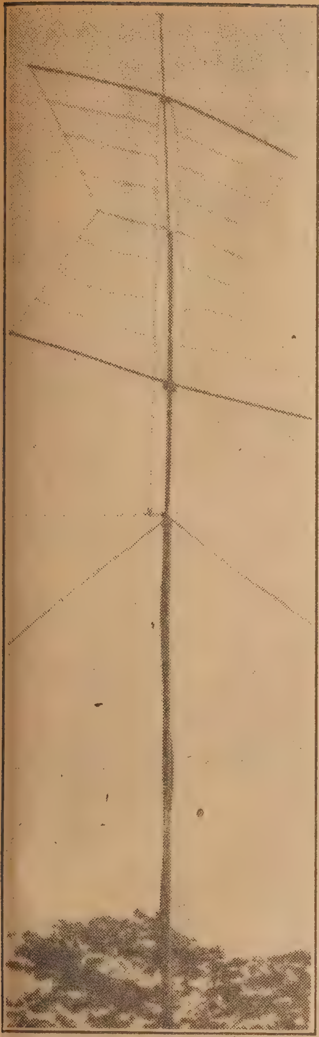


Fig. 1—A test model of the batwing receiving aerial.

The batwing antenna is an extremely wide-band radiator developed by RCA for television transmitting. In its omni-directional form it is known as the "superturnstile" and is used by nearly all television stations.

This "current sheet" antenna has been employed for FM transmitting, but so far has been given little attention as a receiving antenna.

PICKUP PATTERNS

A single element results in bi-directional high gain over the whole band. For those who are situated so that desired stations are in two opposed directions the figure 8 pickup pattern may be best utilised. The pattern in the vertical plane is similar to that of two vertically stacked dipoles half wavelength apart; however, two dipoles so situated present their highest impedance at only one frequency because the natural resonance of a dipole is sharpened in stacked arrays.

The wide-band batwing does not exhibit this undesirable single-frequency effect, and has almost unchanging impedance over the whole FM spectrum while still retaining its bi-directional high-gain feature.

Important dimensions of the antenna are shown. These are not critical. The two edges of the wings are grounded and are fed at the centre. The area within the wing may be filled in at the discretion of the constructor; however, to eliminate the dangerous wind resistance, this area should not be solid.

CONSTRUCTION DETAILS

Copper screening or chicken fence wire may be used. If horizontal members are utilised there should be at least seven between top and bottom.

Fig. 1 is a test model constructed quite inexpensively of two ½in. diameter aluminium tubes and some 7-22 copper antenna wire. The antenna is mounted on the roof of the writer's home, 50 feet above street level, and is affixed to a 25ft mast made of ½in and 1in conduit and ¾in diameter aluminium tubing.

A hundred feet of RG-8/U cable runs to the first floor from the roof. Since the batwing is a completely grounded type of antenna the sheath of the cable may be grounded somewhere near the end, affording complete lightning protection.

AERIAL IMPEDANCE

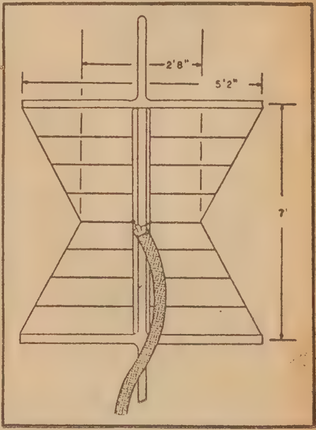
The output impedance of the antenna is not exactly the impedance of the cable (52 ohms) but is close enough for all practical purposes, as the wide-band radiator yields an unvarying standing wave ratio.

The antenna shown in Fig 1 was merely a test model, and although it has withstood fierce winds it is not expected to have a long life. It will be replaced with one fabricated entirely of aluminium tubing welded together. It is contemplated using ¾in diameter tubing for the top and bottom members, ½in for the vertical members, and 3-8in for the inner horizontals—all mounted on a ¾in mast. An antenna constructed in this manner, we believe, will yield optimum, dependable, weatherproof performance for a lifetime.

USING BOLTS

If bolted construction is used instead of the welded construction it is advisable to use tubing and bolts of the same material to reduce the effects of electrolysis.

—Radio and Television.



Dimensions of a typical batwing designed for the American FM band.

AIRBORNE TELEVISION

(Continued from Page 5)

interior of the plane reached 134 degrees F without it.

Full reports of the work have not been released, but it is known that the coverage area was at least equal to the calculated figure. As compared with a 500ft high ground antenna with an angle of five degrees or greater for the first mile, 64 miles was the figure for an antenna at 30,000ft, while for one degree or greater the figures were five miles and 168 miles.

In order to cover a relay across the USA it is estimated that only eight aircraft would be needed as a network, and an additional six planes would give a 78 per cent coverage to 149,000,000 people.

These figures, if they represent the position with any accuracy, undoubtedly give food for thought, particularly when one considers the vast sums which have been and are being spent on relays and cables. The next step seems to be to provide a demand. Only time will tell whether television stations in the sky will ever be able to combine radio and aviation to widen the scope of the nation's radio pictures.

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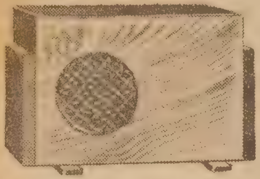

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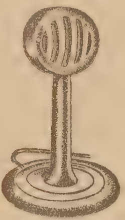

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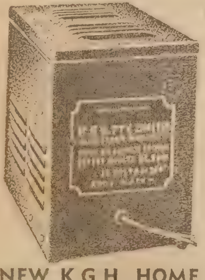

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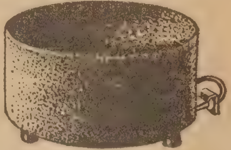

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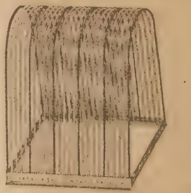

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P.U. COMPENSATING STAGE USES FEEDBACK

Most lightweight pick-ups require bass compensation to ensure a balanced response. While suitable circuits have been published from time to time, this short article by Lawrence Fleming in "Audio Engineering" will be of interest to amplifier designers.

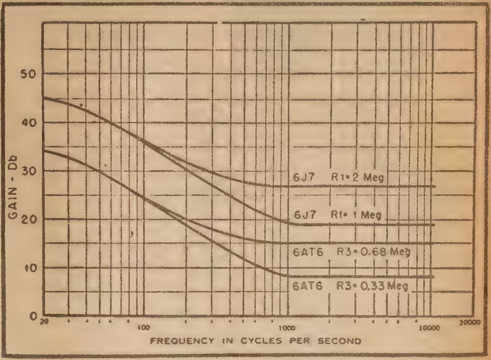


Fig. 3. Here are the measured response curves for Figs. 1 and 2. Alternative values give "turnover" frequencies respectively of 300 and 800 c/s. Other variations are possible.

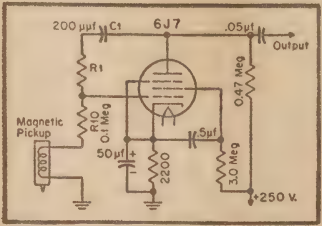


Fig. 1. Schematic for equalized pre-amplifier using a pentode stage.

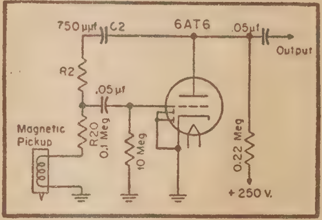


Fig. 2. High-mu triode circuit employing the same principles as that of Fig 1.

BASS equalisation for magnetic pickups is often accomplished by simple resistance-capacitance networks. The RC network is most commonly inserted between two triode stages in the preamplifier. Another widely-used arrangement employs the RC network in the feedback link between the plate of the second stage and the cathode of the first. Both arrangements require thorough filtering of the plate supply to the two stages, and the second type of circuit tends to be "hummy" because the first cathode is off ground.

A third possible location for the equalising RC network is in a feedback connection between the plate and grid of one stage. This configuration is not as well known as it should be, but it is inherently the quietest and most stable. Two practical embodiments of this principle are shown in Figs. 1 and 2, and their measured curves in Fig. 3.

EXTRA COMPONENTS

As illustrated in Fig 1, the circuit comprises a conventional resistance-coupled stage with three added elements: the feedback components C1 and R1 and an isolating resistor R10. Because freedom from hum is particularly sought, it is essential that the cathode be grounded or well bypassed to ground and that one side of the phonograph pickup be grounded. Hence, the feedback must be introduced in parallel with the grid circuit. This makes the input impedance low, as is the case with the phase inverter tube in the well-known "floating paraphase" circuit.

The signal, therefore, is fed to the grid through an isolating resistor R10, and it is required that the impedance of the pickup be low compared to this isolating resistance at all frequencies in the desired range.

For the average type of magnetic pickup having an inductance of the order of 0.2 henries, this requirement is easily met. The circuit is not practicable with crystal pickups, nor is the low-frequency equalisation necessary. The circuit of Fig. 1 employs a 6J7 tube for minimum microphonics and hum.

TYPICAL CIRCUIT

Figure 2 illustrates a practical circuit for a 6AT6 or any other triode having a mu of about 70. "Contact potential" bias is used here, but cathode bias could just as well be employed. The grid coupling capacitor has to be good and big so that it will not counteract part of the bass boost.

The screen and cathode bypassing in the pentode circuit of Fig. 1 has to be ample for the same reason. Referring again to the feedback components, the gain at high frequencies—where the reactance of the capacitor C1 is low—is the gain of a simple feedback amplifier having the fraction R10/R1 + R10 of the output fed back to the input.

The crossover frequency is approximately at the point the reactance of CI is equal to resistance RI. Below this frequency there is less and less feedback, and finally the gain approaches asymptotically the gain without feedback, as in other RC equalising circuits.

The measured curves of Fig 3 show the value of the feedback resistance of crossover frequencies of 300 and 800 cps, for both the circuits described.

It will be noted that the asymptotic low-frequency gain is made equal for each of the two crossover frequencies in the curves of Fig. 3. This results in the gains being unequal at the higher frequencies. It is thought that this scheme is advisable, because below the crossover frequency it allows the gain to increase continuously down to about 40 cps.

If the gains are made equal at high frequencies, the curve for the high crossover frequency will start to level off sooner on the low end than the curve for a lower crossover. This effect can be reduced by sacrificing more gain.

If, however, it is desired to vary the crossover point while holding the gain constant at high frequencies, this can readily be done by leaving R1 constant (Fig. 1) and varying the capacitor C1. To change the turnover from 300 cps to, say, 600 cps, merely reduce the capacitance C1 from 200 PF to 100 PF.

SECRETS OF PLANT GROWTH

(Continued from Page 15)

break this rest period do not arrive at the proper time, so that the plant will bloom or fruit at a later period than normal.

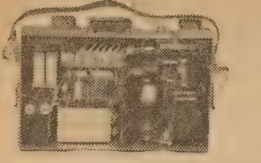
The hormone treatment will break this dormancy, and under certain conditions this is very valuable to such people as fruit-growers, for it guarantees the production of fruit at the correct time at all times.

It will thus be seen that the discovery of hormones is indeed a revolutionary achievement. With their aid almost anything can be accomplished.

We have in this article merely touched the fringe of the matter. In Government laboratories all over the world and in private companies much work is going on with the methods of use and synthetic manufacture of more of these valuable chemicals.

Before much time has elapsed much more will be known and more wonderful things achieved.

In the meantime, to the fellow who "rose" from bed in the early morn and who "aster" dig his garden in his spare "thyme," the idea of hormones should be very "poplar."



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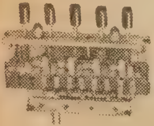

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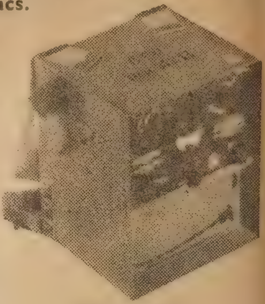

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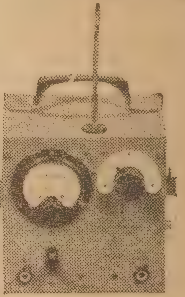


FIELD STRENGTH METER-MONITOR

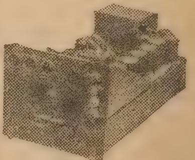
TYPE 98.

Frequency range 100-130 mcs. or can be converted to any other freq. range by altering one coil. Complete with 1N5G valve, imported 3 inch 0-1 MA meter and chrome-plated telescopic aerial. Jack provided for using meter for external measurements, also necessary plug and lead. Batteries encased within the unit. Size 6½ x 7 x 7 inches. Supplied in portable carrying case.

PRICE, New complete, less batteries, F.O.R. . .. £4/10/-

Weight packed, 15lb.

U.H.F. A.S.V. RECEIVERS AR301



Complete with 11 valves: 2—R.F. stages, 954 acorns; mixer and oscillator, 2—955 acorns; 30 mcs. I.F. channel, 4—6AC7's: detector 6H6; cathode follower 6AC7; rectifier 5V4G. Coaxial switching motor, 24-volt D.C. Freqeuency range, 160-190 mcs.

Weight unpacked, 30lb.

Suitable with minor alterations for conversion to F.M. Band (88-108 mcs.). Television Band (175-200 mcs.), 144 or 288 mcs. amateur bands.

Complete with valves as above in vented metal case, size 7½ x 8½ x 18 inches.

Price, F.O.R. £8/15/-

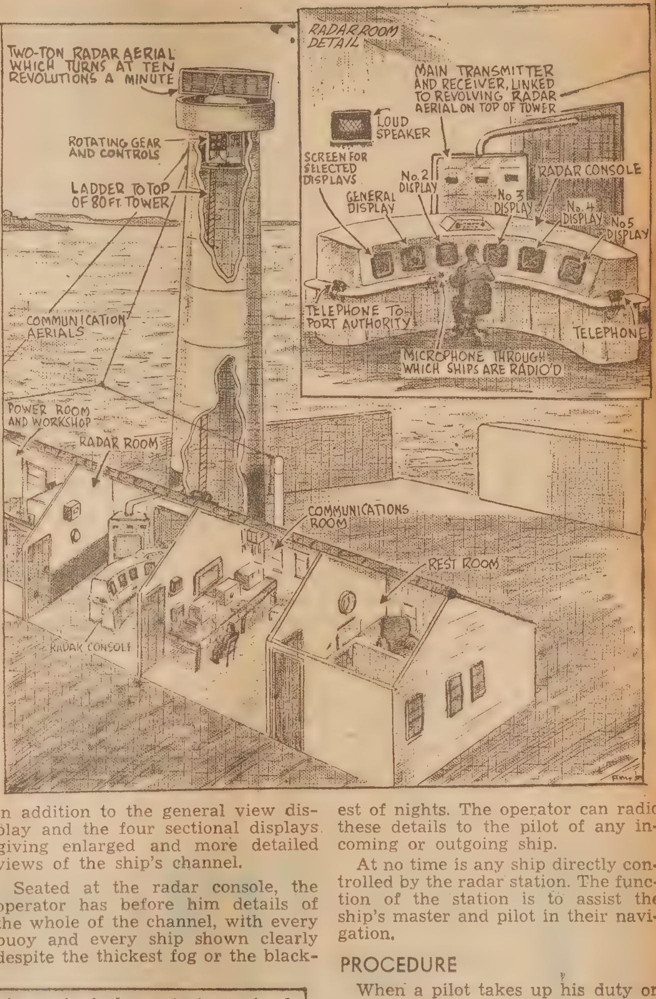
ELECTRONIC EQUIPMENT CO.

Please add exchange to all cheques. Make money orders and postal notes payable at Lewisham. Sorry, no C.O.D.

LM3555—29b West St., Lewisham, Sydney. OPP. END OF LEWISHAM HOSPITAL (ADJOINING RAILWAY LINE) LM3555

RADAR PIERCES HARBOUR FOGS

Developed initially from research undertaken in Britain in the 1930's, radar (Radio Detecting and Ranging) has been turned to many peacetime uses since it first hit the world's headlines as one of the most important military innovations of World War II.


TWO-TON RADAR AERIAL WHICH TURNS AT TEN REVOLUTIONS A MINUTE
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LADDER TO TOP OF 80 FT. TOWER
COMMUNICATION AERIALS
POWER ROOM AND WORKSHOP
RADAR ROOM
COMMUNICATIONS ROOM
REST ROOM
RADAR CONSOLE
RADAR ROOM DETAIL
MAIN TRANSMITTER AND RECEIVER, LINKED TO REVOLVING RADAR AERIAL ON TOP OF TOWER
LOUD SPEAKER
SCREEN FOR SELECTED DISPLAYS
No. 2 DISPLAY
GENERAL DISPLAY
No 3 DISPLAY
RADAR CONSOLE
No. 4 DISPLAY
No 5 DISPLAY
TELEPHONE TO PORT AUTHORITY
TELEPHONE
MICROPHONE THROUGH WHICH SHIPS ARE RADIO'D

THIS method of extending human vision by the use of short radio waves operates on two basic principles. The first is that radio waves bounce from solid objects in the same way as do echoing sound waves. The second is that very short radio waves can be focused in a beam very much like a searchlight.

One of the most valuable fields in which the all-seeing eye of radar has yet been put to use is in assisting navigation. In this field, considerable extension of its use can be foreseen, as radar can break through the barrier created by fog and poor visibility.

LIVERPOOL STATION

First radar port navigation station to be set up, that at Liverpool, England, was opened last year, and these sketches are based on its operation.

Set at the top of an 80ft tower, the radar aerial has a commanding view of the bay and the port approaches. The aerial is rotated at ten revolutions a minute by mechanism in the tower. It is designed to function in winds of up to 100 miles an hour, and precautions have been taken to prevent icing in extremely cold weather by the use of heating apparatus.

Nerve centre of the station is the radar room, in which is located the radar console. This is fitted with six viewing screens and the entrance to the port is broken up into a series of sections or "displays." As shown in the sketch of the radar room detail, there is a special display screen in addition to the general view display and the four sectional displays giving enlarged and more detailed views of the ship's channel.

Seated at the radar console, the operator has before him details of the whole of the channel, with every buoy and every ship shown clearly despite the thickest fog or the blackest of nights. The operator can radio these details to the pilot of any incoming or outgoing ship.

At no time is any ship directly controlled by the radar station. The function of the station is to assist the ship's master and pilot in their navigation.

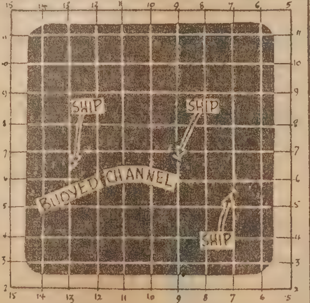
PROCEDURE

When a pilot takes up his duty on an incoming vessel in bad visibility, he contacts the radar station and asks for information on the state of the channel, with details of the positions of shipping moving in it. The operator notes the position of the incoming ship and the positions of other ships in the channel, which he can see clearly in his viewing screens, no matter what the weather may be.

By pressing a button, the operator can superimpose gridlines over the viewing screen. He can then read the position of any ship and can then pass these on to the pilot simply by means of numbers. These the pilot can read off on his own chart.

As the pilot proceeds he is assisted by the station all the way into the dock.

APPROACHES TO PORT AS SHOWN ON GENERAL DISPLAY SCREEN.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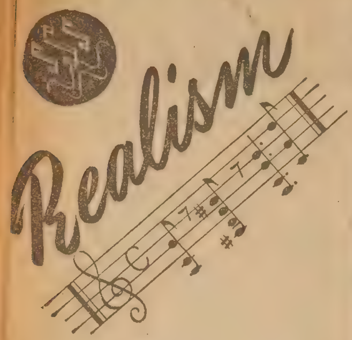
2
SHIP
SHIP
BUOYED CHANNEL
SHIP

GRID-LINES SUPERIMPOSED BY OPERATOR OVER VIEWING SCREEN SO THAT POSITION OF SHIP CAN BE READ OFF AND RADIO'D TO PILOT.



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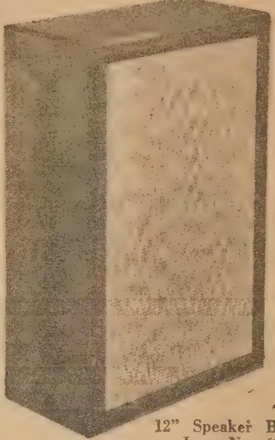

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Item No. 68

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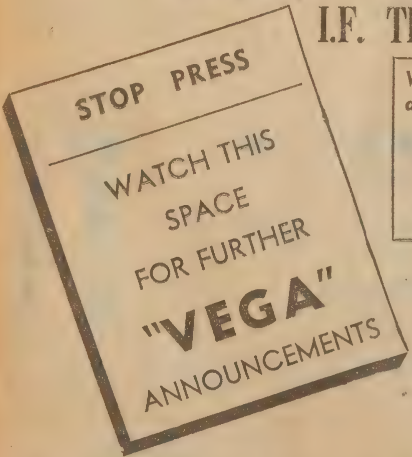

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NEWS AND VIEWS OF THE MONTH

One And One Are Ten

JUNIOR probably won't buy it, but one and one make ten when added on a electronic calculating machine.

On the other hand, he might buy it—considering that under the number system which calculators use, he could learn his addition and multiplication tables in his first day at school.

According to T. M. Berry, General Electric Company engineer, whose work centres about calculating machine design, most "electronic brains" work with a number system based on only two numbers instead of ten.

The method, known as the "binary system," uses only the symbols "0" and "1" and disregards two, three, four, five, six, seven, eight and nine.

First ten numbers in the system are 1, 10, 11, 100, 101, 110, 111, 1000, 1001 and 1010. As compared with the decimal system, 0 is equivalent to 0, 1 is equivalent to 1, 10 is equivalent to 2, 11 is equivalent to 3, etc.

This, incidentally, is the year 11110011101.

With only two symbols, the addition tables are simplified, to say the least: 0 plus 0 equals 0; 0 plus 1 equals 1; and 1 plus 1 equals 10.

A reasonably bright child could commit this mass of information to memory before noon on his first day at school. The same child could then master his multiplication tables after lunch: 0 times 0 equals 0; 0 times 1 equals 0; and 1 times 1 equals 1.

The system is used in calculating machines because it simplifies design. If a machine is set up to handle numbers in a decimal system, its parts must be able to react in ten different ways in order to register any number from one to 10. With the binary system, calculating machine parts need register in only two ways, either "1" or "0."

Electrical devices are essentially two-position machines, and are ideally suited for handling the binary system. The alternatives of "1" and "0" can be registered in a calculating machine as an open or closed switch; as a current flowing in one direction or the other; as a plus or minus charge on a piece of magnetic tape; and in a variety of other ways, each giving a choice between only two alternatives.

The attractiveness of combining electronic tubes and the binary system in a calculating machine can be understood when one realises that a tube can handle as many as 5,000,000 alternate choices in a second.

One does not advocate abandoning the decimal system in favor of the binary system for everyday use, one reason being that the binary numbers take up about three times as much room as those of the decimal system. However, certain features of the binary system are tantalising.

For instance, there is no way of proving arithmetically that three times four equals 12 in the decimal system, or that two times two equals four. Both are matters of faith, learned by heart. Berry points out that both propositions can be proved with binary numbers.

Three times four becomes 11 times 100 under the binary system, and their product is 1100 which is binary-talk for 12. The times two becomes 10 times 10, the product of which is 100, or the binary symbol for four.

One times one equals one in both systems, and in both cases is still a matter of faith.

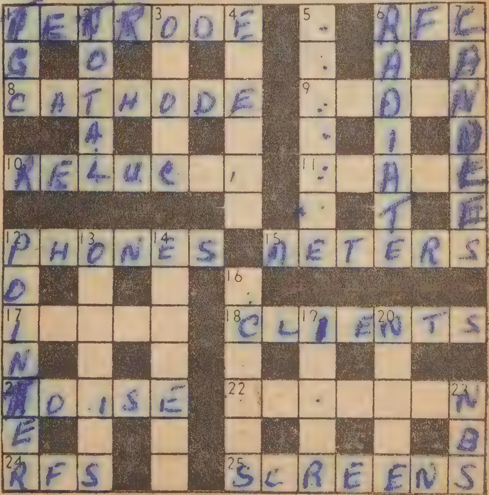
RADIO CROSSWORD PUZZLE, No. 33

ACROSS

1. Four-element valve.
6. Radio frequency choke (abbr.).
8. Valve element.
9. Modern Palindrome.
10. Unit of magnetomotive force.
11. Unwanted frequency in superheterodyne.
12. Headsets.
15. Measuring instruments.
17. Liliaceous plants.
18. Those who try sets out.
21 Pertaining to sound.
22. Electromotive force.
24. Radio frequency selectivity (abbr.).
25. Picture areas on cathode ray tubes.

DOWN

1. Tuned grid coupling (abbr.).
2. Sum.
3. Allotropic form of oxygen.
4. Constructs.
5. Crystal detector.
6. Send waves into space.
7. Units of luminous intensity
12. Dial indicator.
13. Places in positions relative to others.
14. Symbol for dielectric constant.
16. Stationary part.
19. Transmits.
20. The choicest part.
23. Non-break system (abbr.).



BELOW—LAST MONTH'S SOLUTION

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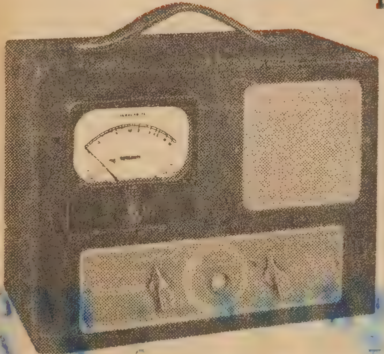
FAST and EASY WORK with these three.

University

Universal Speaker and Output Meter — USO.

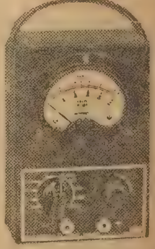
This is a much needed and widely popular Radio Service Instrument combining the functions of an accurate calibrated output Meter with a Universal Speaker designed to suit all types of Radio Receivers and Apparatus whether A.C. or D.C. The Meter is calibrated in decimals and watts, and three ranges of 0-500 Milliwatts, 0-5 Watts and 0-50 Watts are provided. The "University" Square Rectifier type Meter is used and it comes complete with book of Instructions and all necessary Leads.



STB — SIGNAL TRACER.

Self-contained and Battery operated, the STB traces a signal **right through** the Radio Receiver from start to finish. Fault finding is quick and easy. When the probe strikes a faulty section indications are given on both Meter and Speaker. This Portable, light and sturdily constructed Instrument, is a definite necessity for fast, speedy and accurate servicing.

DCM — MULTIMETER.



This small and easily Portable Multimeter is well built and accurate. It provides the following ranges:—

D.C. Volts:—10, 50, 250 and 500.
D.C. Current:—1, 10, 50 and 250 Milliamperes.
D.C. Resistance:—0-1000 and 0-100,000 ohms.

It is entirly self-contained and comes complete with Test Leads and Instruction Card.

University

RADIO KIT SETS • RADIO & ELECTRICAL TEST EQUIPMENT

MADE BY UNIVERSITY GRAHAM INSTRUMENT CO., 5 North York Street, Sydney. Phone BU3169—2 lines.

Tiny Parts

FEW aspects of radio have shown more advancement of recent years than the development of miniature parts of all kinds. Although wartime requirements were largely responsible for hastening their production, the trend was there even before the war.

The demand for such parts has been greater overseas than in Australia, but there is now an increasing number of small parts being imported, and planned for manufacture here.

Tiny valves by yesterday's concepts are now standard lines, and special types are really little more than grains of rice in size. Printed ink circuits, a development reported to have resulted from some stringent wartime demands on the services by Winston Churchill, have cut down assembly size and really baby batteries made by the latest wafer process have been most valuable to the midget set makers.

In USA, the Air Forces have a two-piece battery-operated radio, weighing only five pounds three ounces, against 40 pounds for the type which it replaced. It has eight valves in all, and operates on VHF for air-ground communication.

Coming to simpler things at home, we bought the other day an electrolytic condenser rated at 450 volts working, and eight mfd. It is almost exactly the same diameter as your little finger, and not quite as long.

TV SETS

All this miniaturisation bears with particular emphasis on television receivers. The need for space saving is emphasised when it is realised that the average television set today, has about seven times as many small parts as an equivalent broadcast receiver.

Incidentally, this position is likely to create considerable headaches, not only for service men, but for manufacturers. Averaging out the number of possible breakdowns, this means that a television set is likely to be about one-seventh as reliable as the standard radio, unless manufacturers can make their components seven times as dependable.

In other words, not only must the parts production increase, and designs become smaller, but the parts themselves must be improved even over today's standards, even if we don't apply the seven times estimate too literally.

The enormous demand in the US for television receivers is taxing the set manufacturers, but the pressure is really on for those who have undertaken to make components. To them the special demands of the television market constitute a very real problem.

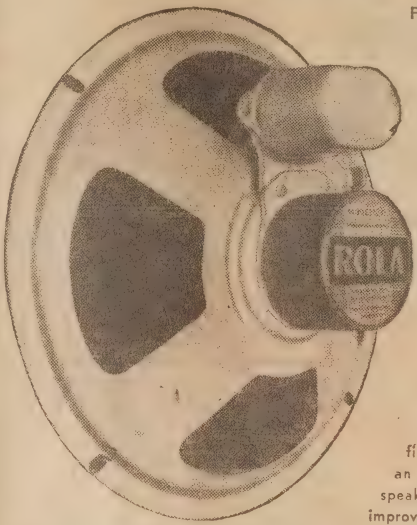
Crystal Tetrodes

The latest use for germanium crystals is the crystal tetrode developed by the Sylvania Electric Co.

The crystal tetrode will operate at higher frequencies than the crystal triode or "transistor." These tetrodes have been used successfully as superheterodyne mixers.

ROLA
THE WORLD'S FINEST SPEAKERS

For sheer quality of reproduction, efficiency and performance nothing equals Rola.



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Rola researchers are forever experimenting and planning for improved efficiency and now offer you an unequalled range of speakers incorporating a new improved magnet alloy.

The Rola range is priced as follows:—

Model	Cone		Retail Price Ea.
3C	3"	without transformer	20/8
3C	3"	with type D transformer ..	26/4
3C	3"	with type G transformer ..	25/9
5C	5"	without transformer	23/2
5C	5"	with type G transformer ..	27/11
5C	5"	with type E transformer ..	25/11
6H	6"	without transformer	30/5
6H	6"	with type D transformer	34/8
6L	6"	without transformer	36/11
6L	6"	with type D transformer ..	41/2
8M	8"	without transformer	40/1
8M	8"	with type C transformer ..	45/7
8MPA		Special P.A. Speaker Less	40/1
10M	10"	without transformer	52/6
10M	10"	with type C transformer ..	58/-
120	12"	without transformer	65/1
120	12"	with type C transformer ..	70/5
12U	12"	without transformer	£11/3/4
12U	12"	with type B transformer .	£11/15/5
12/50	12	Henry 50 M/A choke	6/2
14/60	14	H. choke	8/-

When ordering state type of output valve being used. We will then supply the correct transformer.

Write for free Rola Technical Bulletin No. 8, giving retail prices, illustrations, and technical information on all models from the 3C to 12U, including the new elliptical range.

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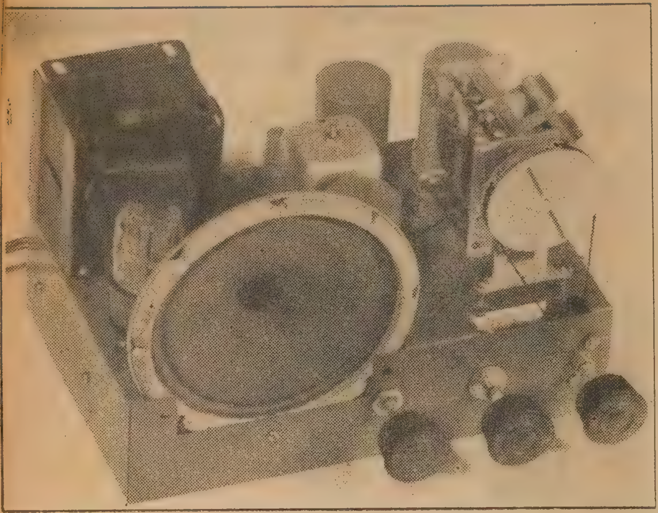


The controls are from the left, Volume, Regeneration and Tuning. The RF valve is just to the right rear of the speaker. Note the trimmers on the 2-section tuning gang.

A T.R.F. MANTEL RECEIVER

Here is yet another design produced essentially for experimenters—for those who want to get the best from small regenerative receivers. The circuit can be adapted readily for home wound or short wave coils—if the interest lies in that direction—or it can be dressed up in a standard cabinet for purely domestic use.

by Raymond Howe

LET us at the outset make the point that this receiver can be considered as a distinctly separate set from the three-valve version which was described in last month's issue.

However, just so that you will not need to read right through the article in order to find out we can assure you that whatever effort you have put into the construction of the three-valve version will not be lost should you decide later to add the RF stage and make the set into the four-valve version described here.

That you will want to do so we feel sure will be the case. The extra stage represents little additional outlay and what it can do to the overall gain figure of the previous three-valve version is not to be lightly discounted.

MORE SELECTIVE

In addition, the extra stage brings a useful increase in selectivity. The inclusion of one more tuned circuit aids the detector in its task of separating adjacent stations. While the selectivity is not as good as that of a superhet receiver, by careful adjustment of the reaction control we were able to obtain good speaker reception of 3AR, even under the "electrical" shadow of the big 2FC transmitter here in Sydney. Other Melbourne stations were received also in between strong Sydney commercials.

You will see that the design of this four-valve set follows on from the three-valve version and, apart from the additional wiring of the RF stage, changes to the original circuitry for the two other valves are of a minor nature only.

In last month's article we spoke of the ubiquitous EF50 and of the reasons why such valves were presented in these two circuits. Just to bring the points into perspective again, the EF50 is a high-gain pentode used widely in British equipment during the last war and which has been, and still is, available in Australia through Disposals sources.

The high transconductance of this valve enables it to give a good account of itself with small input signals both in RF and audio service. As an audio power amplifier it will give an output of the order of 0.5 watt into an optimum load of 20,000 ohms for a grid drive of approximately 1 volt.

As an RF amplifier between selective circuits the high stage gain of this valve can prove both an advantage and an embarrassment, at least in a broadcast set.

The problem is not quite the same as when the valve is used in a communications type of receiver on the high frequencies where circuit dynamic impedance is lower, losses are higher and physical construction, including chassis layout, is specifically designed to cope with high stage gain.

LIMITING GAIN

When these factors are not present it becomes virtually impossible to use the EF50 "flat out," and some limitation has to be placed on the gain.

This observation is closely linked with the method of controlling the overall gain of the set, or, in other words, the level of volume from the speaker.

As a matter of interest let's work from the audio end of the set and see where we could insert a control on the volume. If the 1 megohm grid resistor of the EF50 output valve were turned into a potentiometer with the moving arm connected to the grid of the valve, we would certainly control the speaker volume but that's about all.

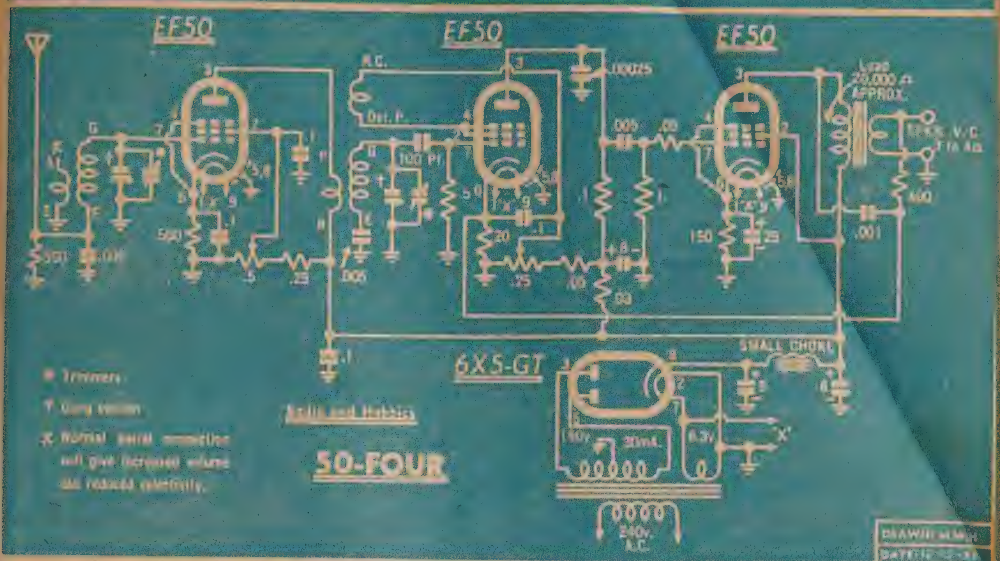
There would be no means of preventing the detector from being overloaded by the incoming signal.

THE DETECTOR

In looking for a spot for such a control in the detector stage we are met with another problem. Quite apart from the matter of signal overload we cannot use the screen potentiometer as a volume control, because it also controls the selectivity of this stage. Since selectivity is of prime importance the volume control must end up in the RF stage.

Thus, controlling the gain of the RF stage is a ready means of doing all that we want apart from possibility of overload in the RF valve itself. However, under normal circumstances this is not likely to occur and, besides, it can be controlled by the length of the aerial.

CIRCUIT DIAGRAM OF THE 50-FOUR RECEIVER



Here is the circuit with the RF stage added. Note the alternative aerial connection as mentioned in the text. The filter cho is optional provided that the filter capacitor is increased to at least 24 mfd.

Considering the circuit diagram as a whole, you will see that the method of aerial coupling to the RF grid circuit is the same as used in the three-valve version. The reason, as mentioned in the previous article, is to obtain very light coupling and a low impedance aerial input. The advantage gained is reduced loading, or damping, upon the first tuned circuit, with consequent improvement in circuit selectivity. It also permits wide variation in the length of the aerial without materially upsetting the alignment of the two tuned circuits.

However, in some areas it may be better to sacrifice the extra degree of selectivity for the increase in volume obtained by coupling the aerial through the normal primary winding of the aerial coil.

The 500 ohm resistor across the 0.005 mfd series capacitor is there to provide a d-c return for the grid of the RF valve and also to ensure a reasonably low impedance at the mains frequency of 50 c/s.

CONTROL METHODS

In locating a gain control in the RF stage it is necessary to bear in mind that the EF50 is of the sharp-cut-off type. This means that we cannot very well place a potentiometer in the cathode and control the gain by varying the bias on the valve, as is done with the variable-mu type of valves. It would be too easy to run into distortion on strong signals.

Thus, we are left with the choice of two methods of gain control in this stage, that of varying the plate load impedance of the valve or varying the screen voltage.

We tried the former method by placing a potentiometer across the primary winding of the RF coil and taking the plate of the RF valve to the moving arm. The screen was supplied through a fixed series resistor.

Although this method was quite successful in controlling the volume of the set we found that it tended to interact to some extent with the setting of the reaction control.

For this reason, we turned to the method of varying the screen voltage from a divider circuit across the HT supply.

This method worked quite well and permitted good control over the volume. If you encounter slight instability when the gain control is turned "full on," increase the valu of the series resistor from 0.2 megohm up to, say, 0.5 megohm, o higher, if necessary. Alternatively the value of the potentiometer coul be decreased to 0.25 megohm, leaving the series resistor untouched.

ALTERNATIVE CONTROL

In case you would like to try th other method of volume control, w have included a diagram of the relevant part of the set. The potentiometer across the RF coil primary i not critical in value, and may b anything between 0.01 megohm an 0.05 megohm. The value could eve go lower, the only point being tha the lower the value, the greater wil be the shunting on the primar winding. This, however, can be o

PARTS LIST

1 chassis 8⅝" x 5½" x 2¼" (Little General).

1 power transformer 150v. per side at 30mA, 6.3v. winding

1 cabinet to suit (optional)

1 small filter choke

1 miniature 2-gang condenser

1 dial (EFCO MK/17A or similar)

1 standard aerial coil, 1 RF coil with reaction

1 5-inch speaker, 1 small speaker transformer to match voice coil to approx. 20,000 ohms

3 EF50 valves, 1 6X5-GT rectifier

3 EF50 sockets, 1 octal socket

2 gang trimmers

CONDENSERS

3 8 mfd. electrolytic capacitor, 1 25 mfd. 40pv. electrolytic capacitor, 4 0.1 mfd. 200 volt tubular, 3 0.005 mfd. tubular, 1 0.00025 mfd mica, 1 100 pf. mica

RESISTORS

1 1 meg., 1 0.5 meg., 1 0.5 meg. potentiometer, 1 0.25 meg. potentiometer, 1 0.25 meg., 2 0.05 meg., 1 0.03 meg., 2 500 ohm, 1 400 ohm, 1 150 ohm. 1 20 ohm.

SUNDRIES

3 knobs, 2 terminals (1 red, 1 black), 3 3-tag mounting strips, 1 tapped mounting pillar, 1 1¼" by ⅛" bolt (for mounting aerial coil), nuts and bolts, hook-up wire. power flex and plug, solder lugs, solder, etc.

ANNUAL STOCKTAKING

Clearance of Disposals, Oddments, etc.

THESE BARGAINS CAN NEVER BE REPEATED

5" PERMAG SPEAKERS

Well known 5" speaker at less than half price. fitted with 12,000 ohm transformer which is suitable for most battery valves and 6V6 with 150V on screen. Brand new in original cartons.

19/9

Postage 1/3 Extra

MORSE OUTFITS

Morse set with high tone buzzer and fully adjustable key. Ideal for practice or line communications.

5/-

Postage 2/- Extra.

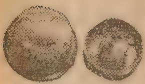
MORSE KEYS

As used on above sets.

3/6

Postage 1/- Extra

L.R. PHONE UNITS



Brand new single phone units. Low resistance type made to Services specifications therefore top quality.

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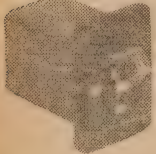
Postage 3d Extra

SWITCHES



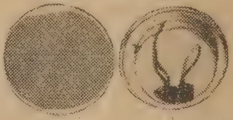
Aircraft switches suitable for all low tension work, radio, car, etc. Moulded case with flush mounting plate. Brand new.

9d ea.

3 FOR 2/-

Postage 3d each

CRYSTAL MICROPHONE INSERTS



The bargain of the year. American crystal microphone insets 1½" dia. The frequency range and output of these units is better than average. Brand new and guaranteed.

15/-

Postage 3d Extra

ENGLISH 75PF CONDENSERS

A rugged 2 bearing condenser for high frequencies. Silvered plates, ball bearings and ceramic insulation. 75 mmF only. New.

5/-

Postage 6d Extra

0—1mA METERS

Brand new, best quality English O-1 mA meters 2" flush mounting type. These are a genuine bargain and stocks will not last long.

32/6

Postage 1/- Extra

SUNDRIES

St'dard size 2 cell torch cases. New	2/6
Rola Speaker Windings. New	1/-
4 & 5 Pin Speaker Plugs	6d
USA 18 volt Genemotors. As new	30/-
Army Carbon Hand Microphones. As New	5/-
English N.P. Toggle Switches. New	2/6
Relays. 150-150 ohms Coil. As new.	5/-
Relays. 10,000 ohms Coil. As new	7/6
EF50 Valves. Guaranteed	10/-
Mixed resistors and Condensers, ex disposals. A useful assortment. ½lb packets. Post free.	2/6
Transmitting Condensers, 100 mmF. As new.	7/6

DYNAMIC PHONE UNITS

Genuine dynamic phone units, in bakelite case with ear pad. Impedance 45 ohms. Ideal for microphones or small loud speakers. Brand new.

5/-

Postage 6d Extra

SOUND POWERED UNITS

A headphone and microphone set using balanced armature magnetic units. Very sensitive and no batteries are required. Two sets can be used for a simple telephone system. New.

17/6

Postage 2/6 Extra

COILS

Standard type iron cored aerial and oscillator coils for 6A8, 6J8, etc. Can be used in most new sets and as replacements in many older types. Per pair.

4/-

Standard types Kingsley I.F. Transformers.

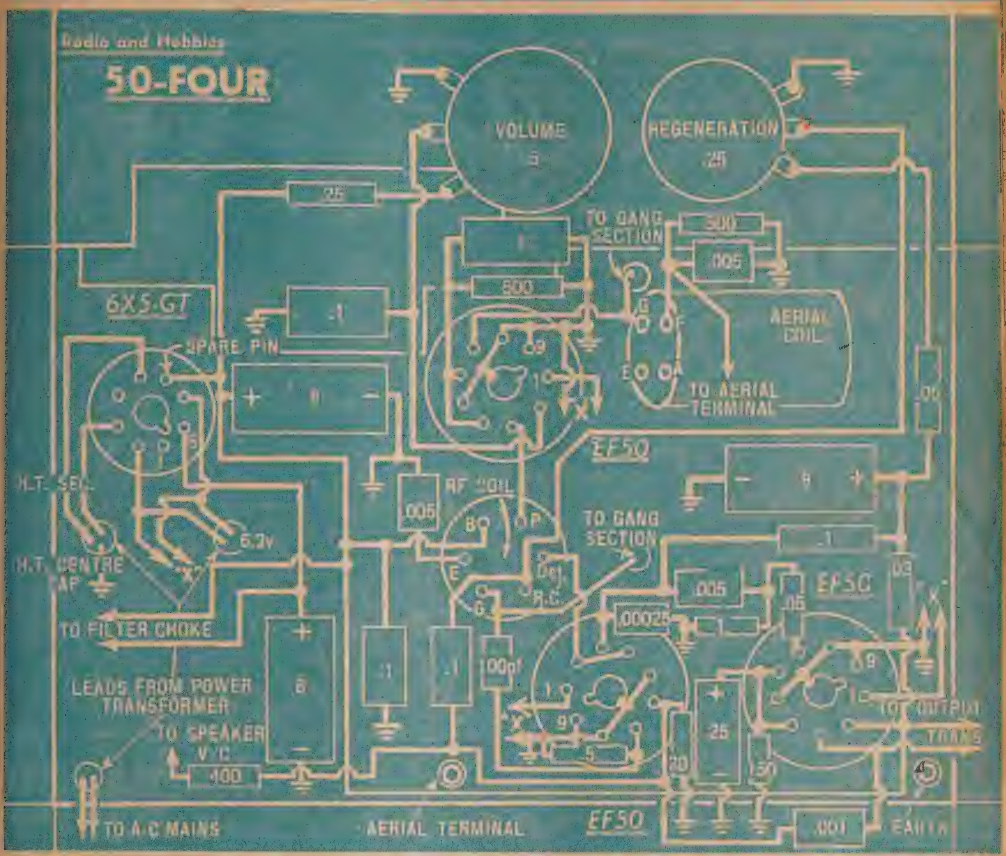
2/-

Postage 3d per coil

PRICE'S RADIO

5—6 Angel Place, Sydney

FULL DETAILS OF THE UNDER-CHASSIS WIRING


Radio and Hobbies
50-FOUR
VOLUME
.5
REGENERATION
.25
.25
TO GANG SECTION
500
.005
.1
500
6X5-GT
.1
SPARE PIN
+ 8 −
G
F
AERIAL COIL
E
A
TO AERIAL TERMINAL
.09
1
X
.005
EF50
− 8 +
H.T. SEC.
RF COIL
B
P
TO GANG SECTION
.1
6.3v
X
E
Det. R.C.
G
.005
EF50
.03
H.T. CENTRE TAP
.00025
1
.05
X
TO FILTER CHOKE
+
.1
.1
100pf
1
9
LEADS FROM POWER TRANSFORMER
8
1
9
+
TO OUTPUT TRANS
TO SPEAKER V/C
.25
X
.5
20
−
400
50
EF50
.001
TO A.C. MAINS
AERIAL TERMINAL
EARTH

This diagram is similar to the one published last month except that the wiring of the RF stage is shown. Keep the RF stage grid lead and other "hot" leads tucked close to the chassis.

assistance in some cases, and help to stabilise the RF stage.

As far as the choice of coils are concerned, there is also a certain amount of leeway. In our case, we replaced the original Reinartz coil used in the three-valve version with an RF coil with reaction and used a standard aerial coil in the grid circuit of the RF valve.

VARIOUS COMBINATIONS

The main point is to provide two tuned circuits, the second of which carries a primary winding and a reaction winding. The original Reinartz coil could be pressed into service in the detector stage by removing the bottom end of the "long aerial" coil primary from terminal number 5, which it shares with the bottom end of the grid winding. This free end is taken to terminal number 2 after the "short aerial" lead has been removed and left floating.

In view of the fact that the load requirements of an EF50 is around 20,000 ohms, it is well nigh impossible to obtain this load from a miniature transformer and at the same time expect it to have sufficient inductance for the response to hold up at the bass end.

However, to improve this condition somewhat, negative feedback is introduced between the voice coil winding of the output transformer and the cathode circuit of the detector stage.

The value of 400 ohms was selected such that with about 20 ohms i the detector cathode, the amount o feedback approached about 9 dl The detector cathode resistor shoul be kept down to this low figure t avoid placing a standing bias o the grid of this valve.

The 0.001 mfd capacitor from th plate of the output valve to th cathode of the detector fulfils tw purposes, one of providing negativ feedback at RF and high audio fre quencies and the other of producin some fixed high-note attenuation.

RESISTOR COLOR CODE

VALUE	BODY	END	DOT
1 megohm	Brown	Black	Green
0.5 megohm	Green	Black	Yellow
0.25 megohm	Red	Green	Yellow
0.1 megohm	Brown	Black	Yellow
0.05 megohm	Green	Black	Orange
0.03 megohm	Orange	Black	Orange
500 ohms	Green	Black	Brown
400 ohms	Yellow	Black	Brown
150 ohms	Brown	Green	Brown
20 ohms	Red	Black	Black

POWER SUPPLY

As mentioned in last month's article, the power supply is a standard affair, supplying just undei 200 volts at a current drain varying between 14 and 16 mA, depending upon the setting of the screen controls.

Under the circumstances, almost any small choke will do a good job of filtering. However, it is actually possible to dispense with the choke

R.C.S. PRICE LIST FOR 1950

INTERMEDIATE TRANSFORMERS

STANDARD 455 Kc/s ROUND CAN DIMENSIONS 2½" x 1 3-8"

IF170 1st Stage Permatune Iron Core	13 9
IF171 2nd Stage Permatune Iron Core	13 9
IF172 1st Stage Permatune Iron Core	13 9
IF173 2nd Stage Permatune Iron Core	13 9
IF174 Low Gain Permatune Iron Core	15 0

STANDARD 460 Kc/s SQUARE CAN DIMENSIONS 3" x 1 3-8"

IF162 1st Stage Permatune Iron Core	13 9
IF163 2nd Stage Permatune Iron Core	13 9
IF164 Low Gain Permatune Iron Core	13 9

MAGNASONIC 455 Kc/s ROUND CAN DIMENSIONS 2" x 1"

IF168 1st Stage Permatune Iron Core	12 6
IF169 2nd Stage Permatune Iron Core	12 6

STANDARD 175 Kc/s SQUARE CAN DIMENSIONS 3" x 1 3-8"

IE74 1st Stage Permatune Iron Core	13 9
IE75 2nd Stage Permatune Iron Core	13 9

F.M. TYPE

IF180 10.7 Meg. Iron Core Permatune	13 9
IF181 Ratio Detector Iron Core Permatune	17 6

COILS

STANDARD SUPERHET BROADCAST ROUND CAN DIMENSIONS 2" x 1 3-8"

E356 Iron Core Permatune Aerial	8 6
E357 Iron Core Permatune R.F.	8 6
E358 Iron Core Permatune Oscillator	8 6

STANDARD SUPERHET BROADCAST SQUARE CAN DIMENSIONS 2 3-8" x 1 3-8"

E342 Air Core, Aerial	6 6
E343 Air Core, R.F.	6 6
E344 Air Core, Oscillator	6 6
E345 Iron Core Permatune Aerial	8 6
E346 Iron Core Permatune, R.F.	8 6
E347 Iron Core Permatune, Oscillator	8 6

MIDGET MAGNASONIC BROADCAST ROUND CAN DIMENSIONS 1" x 1"

E352 Iron Core Permatune, Aerial	6 6
E354 Iron Core Permatune, Oscillator	6 6
E353 Iron Core Permatune, R.F.	6 6

F.M. COILS

E362 Aerial	2 6
E363 Aerial Coupling	2 6
E364 Oscillator	2 6

T.R.F. COILS

T81 Air Core Reinartz	6 6
T82 Air Core Reinartz in Can	7 6
T87 Air Core R.F. with Reaction	6 6
T88 Air Core, Aerial	6 6
T89 Air Core, R.F.	6 6

SHORT WAVE COILS

H121 Iron Core Permatune, Aerial	5 0
H122 Iron Core Permatune R.F.	5 0
H123 Iron Core Permatune Oscillator	5 0

LOOP AERIAL COILS

F125 Standard 6" Diameter	7 6
F126 Midget 4" Diameter	7 6

5 BAND SHORT WAVE AND BROADCAST

H124 10 Metre Aerial	5 6
H125 10 Metre R.F.	5 6
H126 10 Metre Oscillator	5 6
H127 20 Metre Aerial	5 6
H128 20 Metre R.F.	5 6
H129 20 Metre Oscillator	5 6
H130 40 Metre Aerial	5 6
H131 40 Metre R.F.	5 6
H132 40 Metre Oscillator	5 6
H133 80 Metre Aerial	5 6
H134 80 Metre R.F.	5 6
H135 80 Metre Oscillator	5 6
H136 Broadcast Aerial	6 6
H137 Broadcast R.F.	6 6
H138 Broadcast Oscillator	6 6

COIL KITS

K116 Standard Personal Coil Kit	£2 2 0
K117 Standard 4/5 Dual Wave Kit (complete with intermediates)	£3 6 0
K118 Midget Personal Coil Kit	£1 19 6
K119 Midget B/C Coil Kit	£1 18 0
K120 5 Band Coil Kit	£4 5 0
K121 4/5 B/C Coil Kit	£2 3 6
K122 5/6 B/C Coil Kit	£2 11 6

DUAL WAVE UNITS

DW29 Standard 4/5 Dual Wave Unit	£2 0 0
DW37 Standard 5/6 Unit with R.F. Stage	£6 10 0

RADIO FREQUENCY CHOKES

RF81 Silk Honeycomb	1 9
RF82 3 Pie 1.7 M/H	4 6
RF83 4 Pie 2.5 M/H	4 6
RF84 5 Pie 4.0 M/H	4 6
RF85 6 Pie 7.0 M/H	4 6
RF86 Cotton Honeycomb	1 6
RF106 Low Tension Vibrator	4 3

LINE FILTERS

LF20 Line Filters ¾ Amp.	£1 10 0
LF24 Line Filters 2 Amps.	£1 18 6

LINE FILTER COIL

RF15 Line Filter Coil ¾ Amp.	12 0

SWITCHES

SW17 5 Band Switch	£3 0 0

COIL LACQUER

KH34 Low Loss Coil Lacquer	2 6

COIL FORMERS

1.24 6 Pin Plug in 1¼" Diam.	3 9
1.25 6 Pin Plug in 1½" Diam.	4 0

DIAL DRIVE DRUMS

MO8 Dial Drive Drum. Complete with Screws, Spring and Cord	3 6

FILTER CHOKES

TC60 100 M/A 30 Henries 250 Ohms D.C. Res.	13 6
TC65 50 M/A 30 Henries 400 Ohms D.C. Res.	13 6
TC80 150 M/A 30 Henries	£1 5 0
TC81 200 M/A 30 Henries	£1 10 0

AUDIO CHOKES

TA4 100 Henries 1000 Ohm D.C. Res. .25 M/A	18 6

VIBRATOR CHOKES

TC58 Low Tension 3 Amps, 50 M/H .5 Ohms D.C. Res	15 0
TC70 High Tension 50 Henries 450 Ohms D.C. Res. 75 M/A	15 0

FILAMENT TRANSFORMERS

TP1 2.5 volts 2 Amps 7 Watt	12 6
TP2 4 volts 1 Amp 7 Watt	12 6
TP3 6.3 volts .3 Amp 7 Watt	12 6
TP55 6.3 volts 3 Amps 15 Watt	16 6

AUDIO TRANSFORMERS

TB42 A Class Single Ratio 3 to 1	£1 1 0
TB43 A Class Push Pull Ratio 3 to 1	£1 2 6
TB44 B Class Push Pull Ratio 1½ to 1	£1 1 0

AUTO TRANSFORMERS

TP80 6.3 volt 4 volt and 2.5 volt	12 6

SPEAKER TRANSFORMERS

TS23 Single Low Imp Triode	10 0
TS24 Single High Imp. Triode	10 0
TS25 Push Pull Low Imp. Triode	10 6
TS26 Push Pull High Imp. Triode	10 6
TS27 Single Low Imp. Pentode	10 0
TS28 Single High Imp Pentode	10 0
TS29 Push Pull Low Imp. Pentode	10 6
TS30 Push Pull High Imp. Pentode	10 6

VIBRATOR TRANSFORMERS

TP81 135 volts 6 volts	£1 2 6

SPEAKER TRANSFORMER REPLACEMENT COILS

F132 Single Low Impedance Triode	5 0
F133 Single High Impedance Triode	5 0
F134 Push Pull Low Impedance Triode	5 6
F135 Push Pull High Impedance Triode	5 6
F136 Single Low Impedance Pentode	5 0
F137 Single High Impedance Pentode	5 0
F138 Push Pull Low Impedance Pentode	5 6
F139 Push Pull High Impedance Pentode	5 6

VOLTAGE DIVIDERS

VD25 15,000 Ohms 2 Variable Clips	5 6
VD28 25,000 Ohms 2 Variable Clips	5 6

TRIMMING CONDENSERS

CG15 2 Plate	1 0
CG16 2 Plate	1 0

FIVE IN ONE TRIMMER

CG27 Four 2 Plate and one 3 Plate	4 6

DIALS

DA7 D/W Portable Kit Dial	11 0

POTENTIOMETERS AND RHEOSTATS

Type	Ohms	M/A	Price
PT40	6	250	7 6
PT38	10	250	7 6
PT39	20	250	7 6
PT34	30	250	7 6
PT42	100	100	7 6
PT46	400	50	7 6
PT47	1000	35	7 6
PT48	1500	35	7 6
PT49	2500	30	7 6
PT51	5000	30	7 6
PT52	10,000	20	7 6

PADDING CONDENSERS

P21 455 K.C.	2 6
P22 262 K.C.	3 0
P23 175 K.C.	3 6

AERIAL FILTERS

AF21 Aerial Filter	—

MIDGET VARIABLE CONDENSERS

Star Type with Face support.

Type	mmfd	Plates	
CV34	10	2	4 3
CV35	15	3	4 6
CV36	25	4	4 9
CV37	35	5	5 0
CV38	50	7	5 9
CV39	70	9	6 4
CV40	100	14	7 0

M.C. Type with Face and Back Support.

Type	mmfd	Plates	
CV41	10	2	7 6
CV42	15	3	8 0
CV43	25	4	8 7
CV44	35	5	9 3
CV45	50	7	9 9
CV46	70	9	10 3
CV47	100	14	11 3

WIRE WOUND RESISTORS

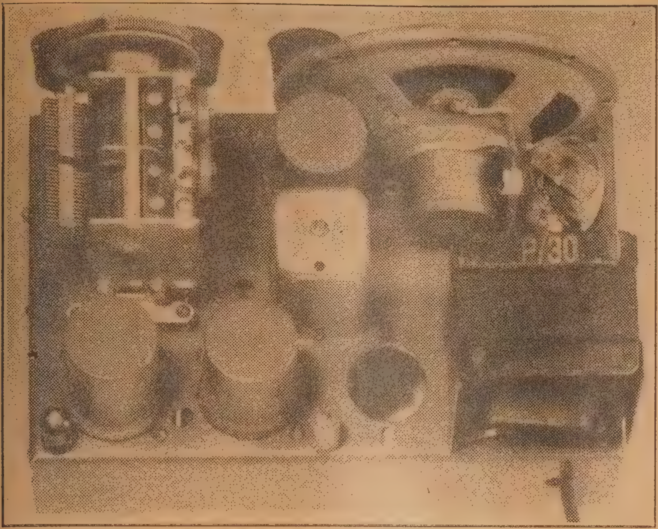
0 Ohms to 1500 ohms 100 M/A	1 0
1500 Ohms to 2500 Ohms 50 M/A	1 2
2500 Ohms to 10,000 Ohms 25 M/A	1 2

CENTRE TAPPED RESISTORS

10, 20, 30, 75, 100 & 200 Ohms	1 2

R.C.S. RADIO PTY. LTD., 174 Canterbury Rd., Canterbury, NSW

REAR AND UNDERNEATH VIEWS



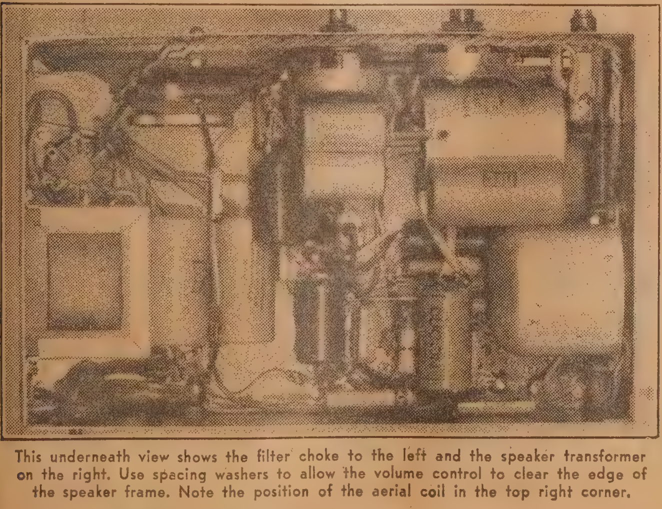
This photograph shows how the major components fit onto the "Little General" chassis. The RF valve is towards the front centre with the RF coil with reaction behind it. Along the rear, the output valve is at the left near the earth terminal with the detector towards the power transformer.

and achieve much the same degree of filtering if the filter capacitor is increased to at least 24 mfd. and preferably higher.

The underneath wiring diagram will give a good idea as to the orientation of the coils and valve sockets to ensure reasonably short leads in the wiring. Keep plate and grid leads well separated, and, if possible, tucked close to the chassis. Don't forget to earth one side of the heaters, the valve shields, the centre spigot of the valve sockets and one side of the voice coil of the speaker. Run the lead to the aerial terminal around the power supply end of the chassis keeping it well tucked down and away from "hot" RF leads.

In the mounting of the aerial coil, a long bolt of at least 1¼ inches was secured through the hole in the top of the coil can, and then fastened to the side of the chassis with a couple of extra nuts. An extra hole was drilled in the chassis side to permit access to the slug.

If, when the set is first switched on, there is a squeal coming from the speaker, it is more than likely that the wrong side of the voice coil has been selected for the feedback to the detector. It is merely a mat-



This underneath view shows the filter choke to the left and the speaker transformer on the right. Use spacing washers to allow the volume control to clear the edge of the speaker frame. Note the position of the aerial coil in the top right corner.

MOTOR-CAR ENGINEERING

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"You have done more for me than can put into words. When I enrolled was just a Farm-hand. Now I own m own garage."

"I am progressing well as a Moto Mechanic and now draw £10/16/- per wee I thank you for the training you ga me."

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"Q PLUS SPHEROCLAD"

AN IDENTIFYING NAME FOR ONE OF THE MANY SERIES OF "Q PLUS" COILS & I.F TRANSFORMERS

Spheroclad Type Nos.
MIDGET

AC1 Midget Aerial
AC2 Midget Aerial Car Type
RC1 Midget RF
RC2 Midget RF Car Type
RC6 Midget Reinartz
IF1 & 2 Midget IF's

?

Spheroclad Type Nos.
STANDARD

AC5 Standard Aerial

RC5 Standard RF

IF 8 & 9 Standard IF Transformers

"Q Plus" Coils which feature the type of construction in which the windings are enclosed by iron dust pots are now to be known as "Spheroclad." **A new name for a well tried type of construction.** However, as the name implies, the iron dust particles are spherical in shape and it is this fact which allows the insulating bond to totally surround each particle thus ensuring a high and consistent "Q" factor.

The iron dust particles used by "Q Plus" are made by the world famous "Carbonyl" method and are available for frequencies up to 200 megs—far beyond any other ferromagnetic material at present being marketed in Australia.

WARNING — Intending purchasers are warned that the new "Spheroclad" Coils have exceedingly high "Q" Factors, and unless care is taken to keep leads short and suitably spaced, instability may result.

PRE-RELEASE ANNOUNCEMENT

Our design department has now completed the latest "Q Plus" dual wave bracket series with R.F. stage—not ready for the distributor's shelves yet—but soon—so be patient and SAVE MONEY.

CAR RADIO COIL KITS

This winter build yourself a Car Radio— the Kits now available are of the "Spheroclad" construction and are specially designed not only to have high sensitivity, but also high signal to noise ratio—an essential element with these type radios—thousands have been built and we have hundreds of written testimonials—each Kit is supplied with circuit, etc.—each Kit is guaranteed.

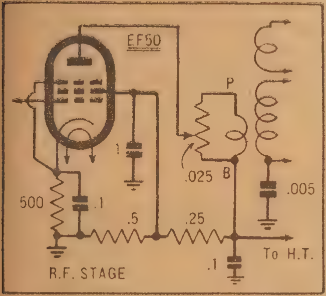
"Q PLUS" DESIGNED FOR APPLICATION COMPONENTS
ARE AVAILABLE FROM
ALL LEADING RADIO SUPPLY HOUSES

R.W. STEANE & Co. Pty. Ltd., Auburn, Vic.

ter of reversing the connections, that is, to earth the opposite side and take the feedback resistor from the side which was earthed previously.

Once this has been corrected, set the RF gain control to about one-third on and rotate the detector regeneration control for evidence of regeneration. Tune in a station near the low frequency end of the range, advancing the volume control, if necessary. While keeping the detector just on the verge of oscillation, adjust the slug of the aerial coil for best reception of the station.

Now, tune in a station at the high frequency end of the range and adjust the trimmers across the detector circuit gang section until the station is tuned in at about its correct place on the dial. It will be necessary, of course, to readjust the tuning each time that this trimmer is adjusted. If the trimmer capacitance is increased, the tuning gang will need to go out of mesh further and vice-versa.



An alternative method of controlling the RF gain. If instability occurs, increase the 0.25 meg. resistor or decrease the 0.5 meg. resistor in the screen divider.

Now select a weak station at the high frequency end, and while keeping the detector just on the verge of oscillation, adjust the trimmer across the RF circuit gang section for best reception. You will find that it will be necessary to "touch up" both the tuning and the regeneration for each setting of the trimmer.

Once the circuits have been aligned, note whether the RF stage falls into a state of oscillation when the volume control is turned up. If such is the case, try reversing the plate and HT connections to the primary winding of the RF coil. Final adjustment may be made by increasing the value of the resistor in series with the RF screen potentiometer.

Finally, the aerial length should be adjusted to suit your particular location and your reception requirements. An earth lead may or may not improve reception, it being dependent upon the characteristics of the aerial and, in some cases, the electrical wiring in the house.

Well, that's the story. You will find that this set performs remarkably well for a TRF of this size and type, and it will certainly provide you with a lot of fun, whether your interest is in entertainment or experiment.

Build your rig with

EDDYSTONE

for real "D-X-ing"

There is a complete range of Eddystone components for the enthusiastic amateur, each one designed purely for and specifically for exacting amateur requirements.
Listed fully are details of six of the most popular Eddystone components. Many more are available to amateur builders. For full particulars, call or write.

R.F. CHOKES

1011—5.6 microhenry Inductance		3/-
1010—1.2	" "	3/6
737—2.5	" "	4/7
1022—1.5	" "	4/7

MICRODENSERS

581	12/10 each	588	14/3 each
582	14/- each	583	14/11 each
585	14/11 each	586	15/3 each

Miniature Plug-in COILS

A range of high quality tuning coils, with four pin plug-in bases. Three colour-coded windings are provided, the connections being indicated below.

Coil Type		Frequency Coverage	Inductance Tuned Winding
706/LB, Blue	8/6	33—15 Mc/s.	.65 uH.
706/Y, Yellow	8/6	16—6.7 Mc/s.	3.45 uH.
706/R, Red	8/6	7.5—3.1 Mc/s.	17 uH.
706/W, White	10/6	3.3—1.35 Mc/s.	90 uH.
706/P, Pink	10/6	1.4 Mc/s—720 Kc/s.	300 uH.
706/G, Green	10/6	750—300 Kc/s.	1.65 mH.
706/BR, Brown	10/6	370—150 Kc/s.	6.5 mH.

Flexible DRIVE SHAFT

Cat. No. 530 enables components awkwardly situated to be controlled from the front panel. Adjustable between 4¾" and 6"—90 degrees operation. Frequentite insulation giving ¼" clearance between metal parts. Rustless finish, **11/-**.

Stand Off INSULATORS

A midget insulator made from Frequentite with N.P. brass parts. A useful accessory in the design of ultra short wave receivers and transmitters. The new quality Frequentite closely approaches quartz in its characteristics as a low loss dielectric at high frequencies. Cat. No. 1019.

Moulded INSULATORS

This moulded insulator will be found extremely useful as "Stand-Off" Insulator, "Lead-through" or "Terminal Post." It is supplied in two colours, red or black. Construction is such that neither the insulator portion of the screw will revolve when wires are attached and tightened. It is made with reversible fittings so that it can be mounted above or "through" the chassis. Each insulator is provided with two 2BA units and shake proof washers. They are satisfactory for 1000 volts working. 1½in. high, 1¼in. between fixing screws.
Cat. No. 564, Red. Cat. No. 565, Black.

JOHN MARTIN PTY. LTD.

CHANDLERS PTY. LTD.

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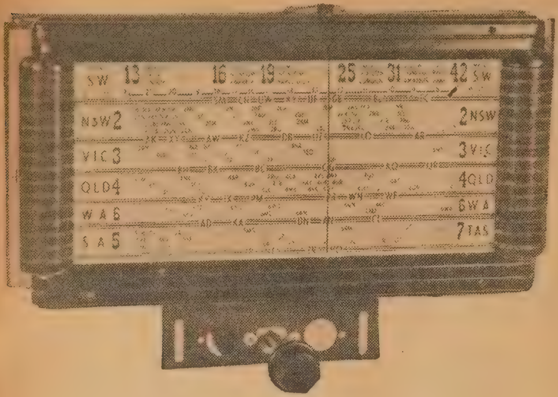

The New
USL-51

A straight line cord driven dial with flywheel action.

This attractive dial with CREAM background, S/wave & local stations MAROON, all other stations GREEN, is illuminated from the back with pleasing effect.

Available in dual wave only for A.W.A. & H gang. Escutcheon. Vision 9"x4½". Overall dimensions 12"x 7¾".

Ask your Radio Dealer to
show you this new unit

THE EFCO
MANUFACTURING CO. PTY. LTD., ARNCLIFFE, NSW

THE CROWN —
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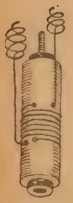

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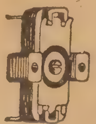

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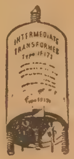

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SIMPLE SUPPLY FOR C.R. TUBES

High voltage supplies for the larger cathode ray tubes are always a problem for the experimenter. An English contributor, himself a television enthusiast, suggests how high voltages can be obtained quite cheaply and using, for the most part, receiver type components. Valve ratings are grossly exceeded but lengthy tests have apparently demonstrated the practicability of the circuits.

By T. W. DRESSER

SOME months ago, faced with the problem of keeping down costs in obtaining the required 2.5 kV. for a CR tube, the writer solved it by using a very old and well-tried circuit with modern components. The result exceeded all expectations both from a technical and a financial angle.

As an indication of the unit's versatility, used in any one of three combinations it will supply a rectified voltage of 700 to 2500, either positive or negative as desired, at a cost of from five to thirty-five shillings, a figure considerably lower than that of most other HT systems.

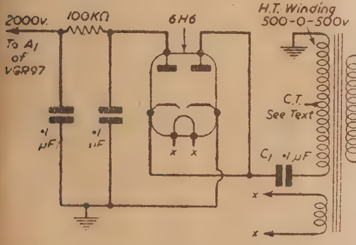


Fig. 1. A circuit giving a 2000 volt negative supply.

Value of C1	D.C. voltage output
.002 mfd	1200
.006 mfd	1800
.1 mfd	2000
.15 mfd	2450

TABLE 1
1000 volts A.C. input in all cases

All condensers 3kv working voltage.

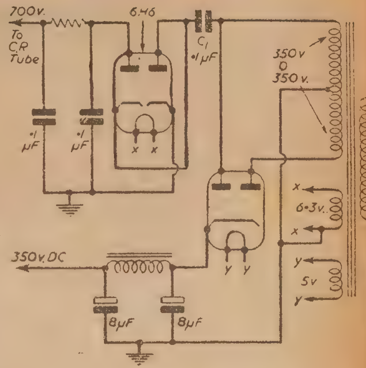


Fig. 2. A circuit giving lower voltage than that of Fig. 1, and suitable for an oscilloscope for instance.

It does not involve the use of any out-of-the-ordinary components nor extended transformer HT windings, and functions with a minimum of small parts readily procurable from advertisers in this magazine or from dealers. Moreover, physically, the entire "works" occupy less than a quarter of the space of either the cumbersome 50-cycle transformer or a modern RF unit.

As has already been stated, there is nothing basically new about the circuit, which is a straightforward voltage doubler using two diodes, but the novelty—and decided cheapness—lies in the use of a 6H6 as the rectifier and in varying the output voltage by the choice of an appropriate capacity for C1, as indicated in Table 1, which also gives the output voltage for any given value of condenser.

It will be seen from the table that the rectified voltage can be swung between 1200 and 2100 by this means without any interference with the rest of the circuit and without in any way effecting the smoothing.

TYPICAL CIRCUIT

A suitable circuit for use with a VCR 97, giving a negative 2000 volts, is shown in Fig. 1. The maximum permissible voltage for this tube is 2500 and as some readers may wish to use this rating they can do s either by raising the input a-c t 1200 volts RMS or by increasing th capacity of C1 from .1 mfd to .1 mfd.

If only some 600 or 700 volts ar required for a small oscilloscop tube these can be secured from th circuit depicted in Fig. 2, which, in cidentally, will cost over and abov the expenditure on the other neces sary components, two shillings fo an ex-Service 6H6.

Fig. 3 shows a circuit for 200 volts positive output, which may b found useful for various purposes.

POSITIVE SUPPLY

It will be noted that in all thes circuits the transformers are of quit standard type. But where the H winding is centre-tapped, the ta should not be earthed in the nor mal manner, except when used as i Fig. 2. A 500-0-500 transforme with the two halves of the winding in series as in Fig. 4, will suppl the 1000 volts input required to giv 2000 DC for a VCR 97, a 350-0-35 similarly will serve for a VCR 138 3BP1 or a 5CP1, and so on.

(Continued on Page 85)

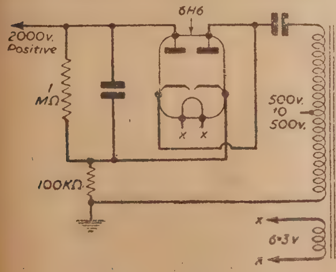
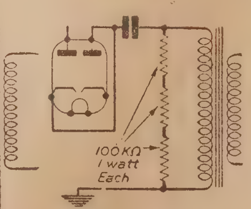


Fig. 3. This circuit will give a positive supply of 2000 volts.



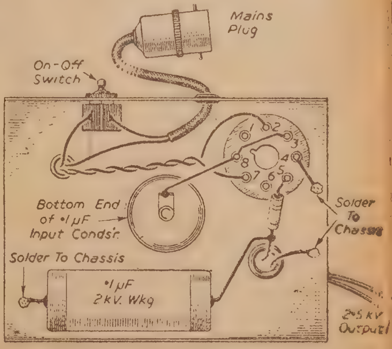


Fig. 4 (right). Suggested layout for the circuit of Fig 3 and Fig. 5 (above) modifications to prevent flashover in 6H6.

Here's your answer, Tom!

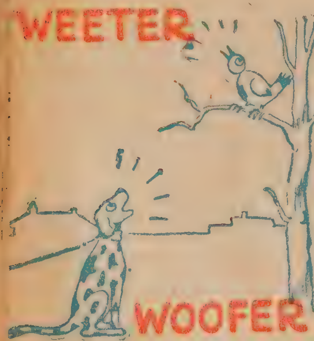
he burning questions, this month, centre round the subject of loudspeakers. Without further ado, we take Tom's queries one by one and do our best to answer them. Perchance the answers may interest readers other than the tireless Tom.

O be sure, the term "loudspeaker" is expressive enough. It hails om the time, not so very long ago, hen most radio listening was done headphones. A loudspeaker was a re and almost an unbelievable lux-y.

Tom is bewildered, however, by rms which are just as expressive t much more modern.

I have noticed reference to woofer" and "tweeter" speakers. Vill you please tell me what these vords mean?

Certainly, Tom, anything to oblige.



"woofer" speaker is one intended pecially to reproduce low fre-ency sounds. Woofers are generally rge—from 12-inch diameter up-ards—have a heavy cone and are d only with signals having a fre-ency below a few hundred cycles r second. They are generally ounted in a large baffle arrange-ent to assist in developing plenty power in the bass register.

If you've never seen a "woofer" eaker, there is a good chance that ou've heard one without knowing it. lany of the sound systems in talkie heatres use a multiple speaker sys-em with a "woofer" to handle the w notes.

A "tweeter" speaker, on the other and, is generally a much smaller nd lighter affair. It is intended to eproduce only the treble register, rom, say, 4000 or 5000 cycles up-vards. Sometimes their range is re-tricted to an even higher group of requencies, according to require-nents of the system.

Tweeter speakers are frequently fitted with a special horn system which radiates the sound outward and forward, distributing it evenly over the audience. Once again, tweeter speakers are frequently used in good quality theatre sound systems.

For the middle register, between a few hundred and a few thousand cycles per second, a third and fairly ordinary speaker may be used. Thus a complete system may have three speakers or three groups of speakers, handling respectively the bass, middle and treble frequencies.

A simpler arrangement is to have one speaker or group of speakers handling all frequencies up to about 5000 cycles and another speaker or group working from there upwards. The same terms, "woofer" and "tweeter," are commonly applied, although not so correctly as in a three-channel system.

I have seen sets with two speakers, one large and one small. Does the small speaker handle the high notes and the large one the low notes?

Ideally, the answer to this question should be "yes," Tom, but we can't help being a little hesitant.

As you will realise from what we have already said, it is common practice in large theatre systems and in elaborate domestic amplifiers, too, to have separate reproducers for the low and high notes. Generally, the low note speakers are larger than the high note speakers, but they are both specially designed for the job.

It does not necessarily follow that all big speakers are bad at the treble end and that all little speakers are suitable for tweeters. In point of fact, many of the small conventional speakers are poorer at all frequencies than their big brothers. Thus, the mere use of two ordinary speakers does not guarantee a wider frequency response.

The best it can offer is a certain "broadening" of the sound source and a possible advantage from separating the low and high frequencies. Technically, it can be said that there is less "intermodulation"—less mixing up of the high and low notes.

Even this assumes that the designer has really separated the audio signals into low and high components and has fed them appropriately into the speakers. Unfortunately, some sets have been marketed with dual-speakers, but with no such provision. Both speakers work in parallel and the technical advantages are not nearly so important as its sales value!

If my previous assumption was correct, how can the low and high notes be separated?

Well, Tom, your previous assumption was right on the mark, so that the present question is a legitimate one.

The proper way to separate low and high audio components is to include a special filter system somewhere ahead of the speakers, which diverts the audio components into the appropriate channel. Sometimes it is done quite early in the amplifier itself, the speakers being fed from entirely separate power stages.

More commonly, the separation is achieved in the speaker supply line, the job being done by a special filter network. If you turn back over the past few issues, you will find various references to tuned filters in pickup, amplifier and voice coil circuits. They are rather heavy "meat," Tom.

A simpler approach, and one often adopted by amplifier enthusiasts, is to connect the small speaker across the large one, but in series with a condenser selected to pass only the treble frequencies. It can be done in the voice coil circuit, but it is generally easier to connect the primary of the smaller speaker transformer, in series with a condenser, across the primary of the larger speaker transformer.

TREBLE HALF PRICE
BASS NOTES THIS WAY
CHANGE

The value of the condenser must be discovered by cut-and-try methods, but you can start with about .01 mfd. Larger values cause the small speaker to respond to increasingly lower frequencies, while smaller values allow it to respond only to high frequencies.

What is the advantage of an output transformer over a loudspeaker transformer? Are there any tricks in substituting one for the other?

Actually, Tom, there's no difference at all, because a loudspeaker transformer is an output transformer.

But let's get this business of the names clear. Dynamic speakers are inherently low impedance devices and they cannot be operated directly in the plate circuit of a valve, as was common with the older cone and magnetic speakers.

Because of this, it has been necessary to provide them with a matching transformer which is normally attached to the frame of the speaker. They are commonly referred to as "speaker transformers" for this reason.

For purely commercial and competitive reasons, these speaker transformers are generally a compromise design—they are good enough for most requirements but just don't have enough iron and copper in their make-up to ensure really high efficiency and low distortion.

While most set and amplifier designers are content to use these transformers and keep the cost down, there are instances where it is considered important to get the very best out of an amplifier or receiver, even if it does entail spending two or three pounds extra. Hence the demand for matching transformers of a more expensive type.

These special transformers are invariably sold as separate items, and, being fairly large, are mounted on the amplifier chassis. In this position, it is more usual to think of them as "output transformers," even though they are doing the same job as a transformer mounted on the speaker housing.

There are no special tricks about their use. Normally, the same connections are made to the plates and B-plus and to the voice coil of the speaker. If the transformer gives a choice of several secondary impedances, use only the "common" tapping and the impedance closest to the rated voice coil impedance. The other tappings or wires are simply bent over and taped to prevent them from shorting to anything else in the chassis.

There are cases where an amplifier is designed for a specific type of output transformer, as, for example, the Williamson circuit recently featured (807 Triode Amplifier). An ordinary cheap outfit transformer cannot be used in a case like this owing to the likelihood of unsatisfactory negative feedback and oscillation.

Other than that, it is largely a matter of £ s d whether you buy an expensive output transformer or use the cheaper one supplied with your speaker.

I note that a good deal is said about the need for baffling dynamic speakers. Why do they differ in this respect from the old cone speakers which simply sat on the table?

In point of fact, Tom, there's no difference at all in the requirements of the two types of speaker. Both have cones and both require some form of baffle to do any good at the bass end.

However, the fundamental design of the traditional cone speaker prevented the large amplitude of movement required by bass notes and, furthermore, the sets of the day were generally incapable, anyway, of producing much in this part of the spectrum.

With the dynamic speaker, however, came a movement which was capable of reproducing good bass notes, and the listening public gradually became low-note conscious. From this trend came the practice of baffling the speaker and the use of components and circuits which gave something at the low end for the speaker to work from.

So you see, Tom, there's nothing wrong with your theory. It's purely a matter of development.

I picked up quite cheaply a unit that apparently belongs to a public address horn speaker. Could I improve my amplifier in any way by connecting this unit to it?

You could certainly make your amplifier a lot louder, Tom, although that is not necessarily better.

A modern horn speaker, complete with exponential horn of course, is acoustically several times more efficient than a dynamic speaker on a baffle. However, it is designed only for speech or mediocre reproduction of music and would have nothing to offer in the way of quality. Without the horn, it would be a very tinny and a very inefficient device.

There isn't very much you can do about it, either, Tom, because the diaphragm will be made from metal or hard bakelite with some nasty resonance effects.

In laying out of a receiver, what points should be kept in mind? What valves and what wiring should be shielded?

Unfortunately, Tom, there are no very hard and fast rules, the final decision depending on the type of components used, the number of valves and the shape of the cabinet. However,, there are several basic points to remember.

The stages in the set should progress logically one to the other. Leads should be no longer than necessary and should not pass back over previous stages.

Never use shielded wire in RF circuits unless the design calls for it. If used, it should be the low loss co-axial cable type. Shielded wire should only be used in audio circuits when the leads are long. It is usually desirable to shield the RF valves and, under some conditions, the audio voltage amplifier. In some of the smaller sets, however, both this valve and the converter are left unshielded.

We suggest you study as many layouts as you can find. Knowledge gained in this way, together with practical experience, will help you to overcome your problems.

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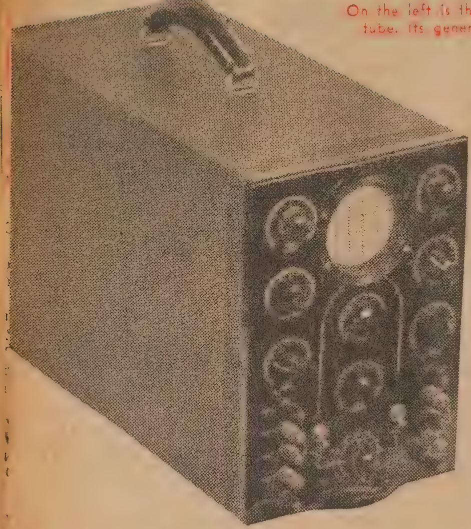
PUTTING YOUR C.R.O. TO WORK

On the left is the Radio and Hobbies 3-inch oscilloscope, using the 3API or 906 type tube. Its general shape and panel layout is typical for an instrument of this type.



Illustrated above is a commercial type oscilloscope using a 2-inch tube. Panel layout is quite different from the Radio and Hobbies oscilloscope, but the controls are essentially similar.

By making visible electrical waveforms, an oscillograph becomes virtually the eyes of a radio engineer. Though formidable in appearance, it is basically a very simple instrument to use. This second article continues this chatty, informal discussion centering round the C.R.O.

by W. N. Williams

OSCILLOSCOPES vary a good deal in their panel layout, but as far general purpose instruments are ncerned, the actual function of the ntrols and terminals follows an cepted pattern. The photograph ows the front panel of our own inch instrument featured in the nuary, 1947 issue.

By way of comparison, the second otograph shows a commercial in- rument using a 2-inch tube.

THE CONTROLS

Referring first to the R & H de- gn, the controls at the top right nd left are marked "Vert. Shift" nd "Hor. Shift." The purpose of hese controls is to allow the spot or he pattern to be moved bodily up down on the screen, or to right or ft.

Variations in components and tubes ake it difficult for the designer to nsure the pattern being in the cen- e of the screen and, rather than ondemn the operator permanently work with an off-centre pattern, is usual to provide spot-shift con- ols.

Occasionally, they can be put to pecial use, where it is desired to ave a particular partion of a pat- rn in the centre of the screen for ose examination. Then again, by eliberately displacing the pattern or pot slightly, it is possible to pro- ect the centre of the screen from ndue wear—for fluorescent screens o wear out after a while.

Referring to the commercial instrument, the shift controls are in different positions, but they are still there and clearly marked.

Occasionally, the shift controls are omitted from the front panel to provide a simple layout, but they will then generally be found on one side of the instrument, or at the back, slotted for screwdriver adjustment. In this case, the spot is normally centred and left that way.

The effect of the shift controls varies with the instrument and its design. Sometimes, the action is quite limited. In other cases, swinging the control through its limits may put the spot right off the screen. If a spot pattern fails to appear, therefore, run the spot shift controls through the full range with the intensity control well advanced until the spot is picked up.

The "Brilliance" or "Intensity" control is fitted to all oscilloscopes, and is appropriately marked. Its purpose is obvious from the name. The Intensity on the screen should never be advanced more than necessary, in the interests of screen life and, furthermore, a light trace is generally sharper than a heavy one. A hood over the screen or a book perched atop the instrument to shade the tube face halves the intensity required for a clear pattern.

The "Focus" control will also be found in all oscilloscopes, and its purpose, too, is obvious. With most tubes the focus and intensity adjustments are inter-related, so that varying one makes it necessary to reset the other for best results.

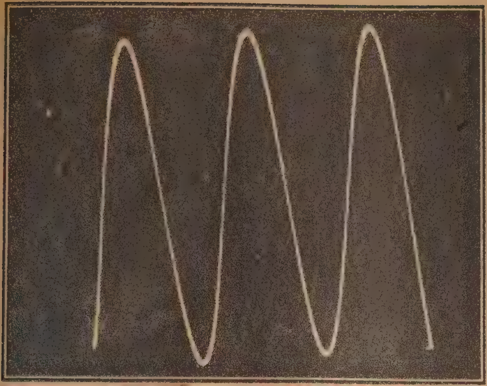
These four controls affect the "writing" characteristics of the tube. All other controls operate on the amplifiers and time base.

TERMINALS BRIDGED

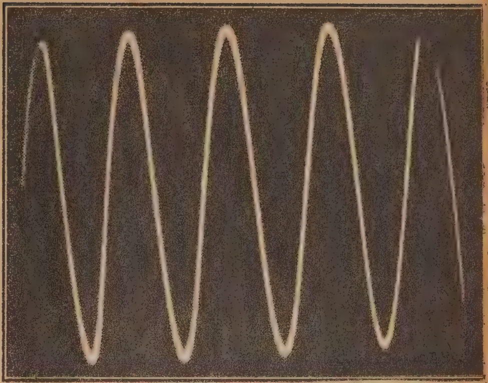
Referring again to the R & H design, input terminals are provided for both amplifiers. In practice, it is usual to feed the waveform to be inspected to the vertical amplifier, so that it produces up-and-down movements of the spot. The terminals are marked "Amp. In." and "Earth" and obviously belong to the vertical amplifier because they are grouped under the "Vertical Gain" potentiometer.

The output from the vertical amplifier is brought to a terminal marked "Amp. O." and this is bridged externally to a terminal above it marked "Def. Pl."

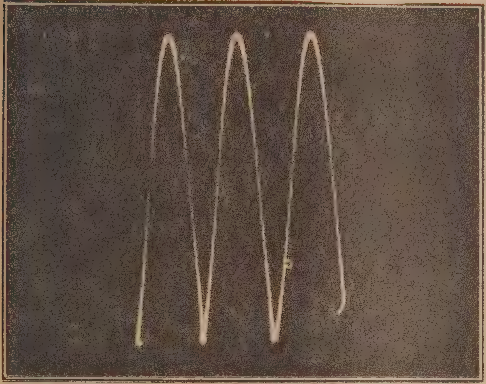
The normal procedure, therefore, is to feed the signal under test into the "Amp. In" terminals. It



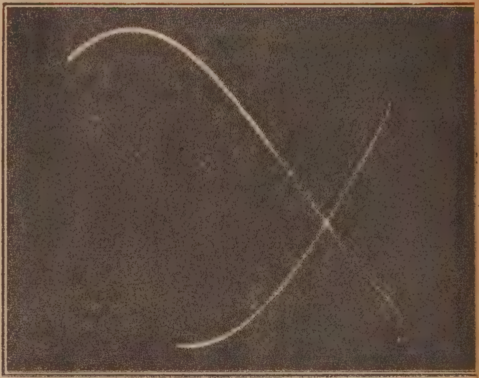
Three sine waves at a frequency of 1000 c/s. Centre of pattern is essentially free from non-linear effects in the time base.



Decreasing sweep frequency and increasing horizontal gain give an even train of waves right across the screen.



One of many possible effects of using too much "Sync." The sine wave shown in earlier photographs is made to appear distorted.



Too high a time base frequency produces a pattern of oblique lines across the tube face. Only two lines are shown here.

will reappear, duly amplified at "Amp. O." and be coupled to the "Def. Pl." to operate the beam. Gain of the amplifier is controlled by the "Vert. Gain" potentiometer.

By disconnecting the bridge between "Amp. O." and "Def. Pl.", direct access can be had to the deflector plate, quite independently of the amplifier. The bridging wire is simply removed, and the signal under test connected between the "Def. Pl." terminal and "Earth."

THREE TERMINALS

By way of contrast, the commercial instrument illustrated has only three terminals marked "E," "V.P." and "V.A.," indicating earth, vertical plate and vertical amplifier. The connection betwen the amplifier output and the deflector plate is thus permanent and the two cannot be completely separated.

In practice, it is not a very important point and the signal under test can be applied directly to the plate as required, or through the potentiometer and amplifier.

In practice, signals are normally fed through the amplifier, if for no other reason than that the control provides a ready means of adjusting the height of the pattern on the screen. Where a test signal is fed directly to the deflector plate, means of adjusting its amplitude externally must be provided, unless it happens to be of a convenient order. In any case, it needs to be around the 50 peak volts mark, depending on the tube, to get a useful pattern on the screen.

Except at the output plate circuit, audio voltages in an amplifier are generally much smaller than this, so that the use of a deflection amplifier is essential.

It is usual to provide a horizontal amplifier in a test oscilloscope, similar to the vertical amplifier, but its operation is closely related to the time base or sweep circuit.

In the R & H 3-inch oscilloscope, the same terminals are provided as for the vertical amplifier. Thus, in a line down the right-hand side there are terminals marked "Earth," "Amp. In," "Amp. O" and "Def. P," the last two normally being bridged across.

A point of difference, however, is that the lead from the "Amp. In" terminal runs to a switch rather than straight to the grid. To complete the circuit, this switch must be set to the "Ext. Sweep" position.

When set to the alternative "Internal Sweep" position, the amplifier takes its signal from the time bas

All normal test oscilloscopes hav a similar provision, although the exact position and marking of the knob may vary slightly. The commercia instrument illustrated has the thre terminals, "H.A.," "H.P.," and "E., as for vertical deflection, but a kno marked "Time Base — External switches the input for the horizonta amplifier from the "H.A." terminal t the internal time base circuit, as required.

TIME BASE

There are nearly always three controls for the time base—a coarse frequency adjustment involving switch, a fine frequency adjustmen and a synchronising control, all appropriately marked.

The exact frequency range covere by the sweep oscillator varies fror one instrument to another, but i commonly extends from about 2 c/s to 20 Kc.

The sweep oscillator or time base as it is commonly called, produces saw-tooth waveform which moves th spot at a relatively slow but regular speed across the screen, allowin it to trace one or more complete wav patterns. The return is very rapid resulting in a dim and rather mean

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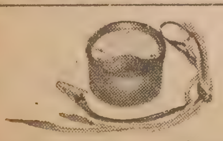

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In Ivory Cabinet	68/-
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A high grade plastic covered copper wire that will find a multitude of uses. Ideal for indoor aerials, extension speaker, leads, hook-up wire, etc.

20ft for	1/2

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Astor 5 Valve Car Radio W/Aerial	£36/7/6
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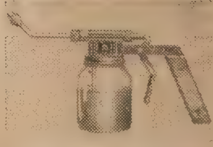

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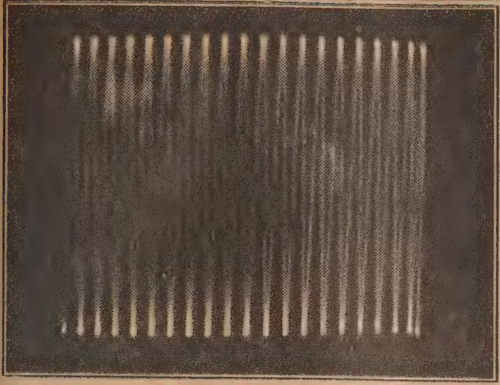
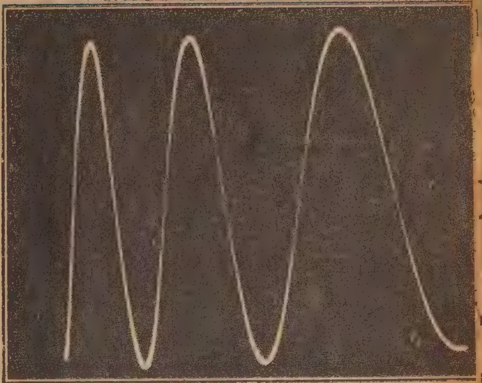
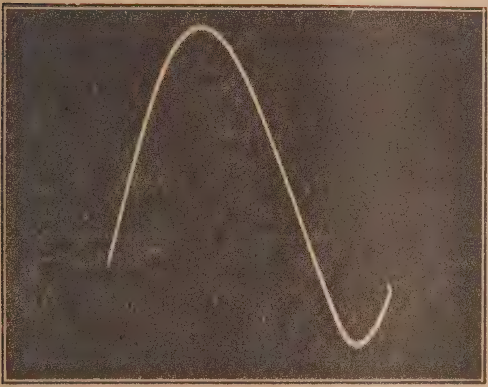
FOUR MORE TYPICAL WAVEFORM PATTERNS



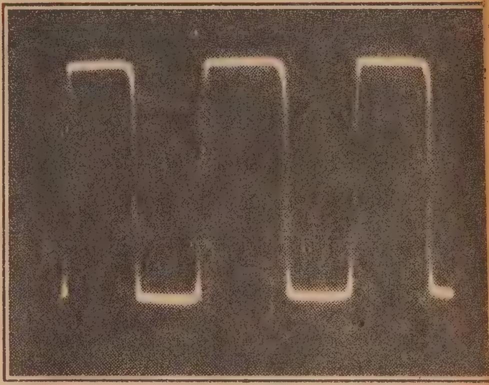
A typical crowded pattern of waves resulting from too low a time base frequency. Carried to extremes the pattern resolves into a solid rectangle of light.



A non-linear time base at low frequencies produces this result—the waves close up at one end of the screen. The effec is common to most simple oscilloscopes.



Non-linear time base at high frequencies reduces one half of a sine wave and reveals the flyback trace. To obtain better results, use a lower time base frequency and spread the pattern out.



A square wave pattern, as provided by some audio generators. Limitations of photographic process tend to emphasise the horizontal lines and suppress the fine vertical traces.

ingless line as a background to the main pattern.

Movement of the spot is constant and so rapid that it cannot normally be followed by the eye, resulting in an apparently unbroken line. Only at very low sweep frequencies is the movement slow enough to create a flicker effect.

To sustain a perfectly stationary pattern of waves on the screen, a circuit is incorporated in all oscilloscopes, which keeps the time base oscillator in step with the signal under test. Known as the synchronising circuit, it feeds a small amount of the signal from the vertical amplifier into the time base oscillator—sufficient to "trigger" the oscillator at the beginning of each cycle.

SYNC. VOLTAGE

The amount of synchronising voltage used depends on the amplitude of the test signal at the vertical plates and also the setting of the special "Sync" or "Synchronise" control, which appears on the front of all standard oscilloscopes.

With large amplitude patterns the synchronising control can be kept well back, while, with small patterns on the screen, it has to be well advanced.

To obtain a stationary pattern on the screen, the procedure is, therefore, to advance the "synchronise" control by about one fifth of a turn—to take an average case—then rotate the coarse frequency switch until the general appearance of the confused pattern on the screen indicates that the time base is generating somewhere near the correct frequency.

Too high a time base frequency produces a series of wavy lines scrawled across the screen, while too low a frequency produces an almost solid block of pattern.

Having judged the rough setting, the fine control is then adjusted until the pattern comes to a halt with one or more waveforms stationary on the screen.

To increase the number of patterns on the screen, reduce the time base frequency and vice-versa. If the pattern tends to wander, even afte careful adjustment of the fine frequency control, apply more synchronisation.

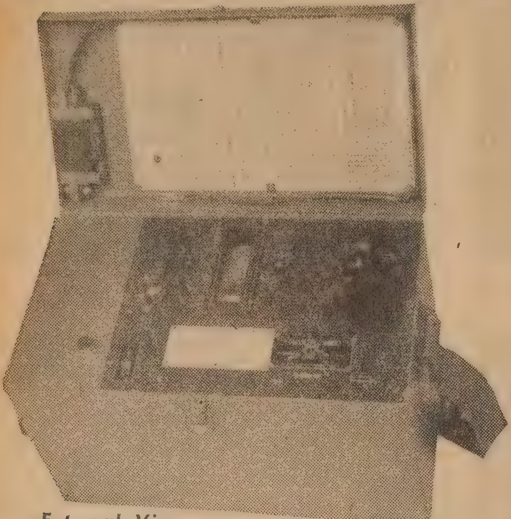
As a general principle, however, i is wise to avoid the use of too muc synchronisation, since it is likely t distort the saw-tooth waveform an create a false impression of the signa under test. Use just enough "Sync. to steady the pattern and no more.

Ordinary time bases are not perfect in their linearity, and, to get the best idea of waveshape, it is a goo plan to set up at least three complete waves on the screen and pay attention only to the inner ones. In poin of fact, it is often possible to set up half a dozen waves on the screen and run the outer waves right off the screen by turning up the horizontal gain. This permits wave shapes to be examined with ease and reasonably free from distortion due to the time base.

Non-linearity in the time base is normally most noticeable at low fre-

ARMY

DISPOSALS EQUIPMENT



External View

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(Class C) (Manufactured By A.W.A. For The Army)

These wavemeters are ideal for the amateur station. Regulations demand that every experimental station has, as a part of its equipment, a calibrated wavemeter. Now is your chance to complete that station with a necessary instrument at a fraction of its original cost.

100 ONLY BRAND NEW

Complete with 6v. Vibrator Supply

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Less Vibrator Supply £8/10/-

A FEW USED, BUT IN EXCELLENT CONDITION

Less Vibrator Supply, £7/7/-

Range, 1470kc. to 10,260kc. In three bands as follows 1470 to 2870, 2800 to 5520 and 5280 to 10,260. Wavemeter operates on:—6 volts A.C. or D.C. L.T. for filament of valve and 90 volts H.T. (no batteries supplied). Valve used 1-6J8.

Jack provided for use with headphones when used for checking transmitter.

Circuit diagram, parts list, working instructions, etc. Supplied with each wavemeter.

Weight 23lb. Size 15¼" x 10¼" x 8¼"

NEW — 200 — 101 Transceivers

Complete stations, in original cases, with full equipment of phones, key, microphone, plugs, cables, valves & meter, power supply.

8-valve, 4.2 to 7 megs. 6-volt operation.

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Ideal for Boat, Mobile, or Amateur use. This unit can also be supplied crystal controlled with greatly increased POWER OUTPUT.

Army FIELD TELEPHONE Type 11

A field telephone by which messages may be sent up to a distance of 3 miles. Operates off 3V. battery and fitted for microphone and headphone or by key operation. 2 units make excellent 2-way telephone system.

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Headphones	10/6
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108 TRANSCEIVERS

A lightweight portable transceiver, dry battery powered, and an ideal unit for bush fire brigades, boat owners, and all purposes where light weight and limited range is desirable.

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PHONE
LA1604

quencies, and the effect is to cause the wave pattern on one side of the screen to be more open than on the other side. Provided the operator understands the cause and allows for it, no great complication results.

At very high frequencies, on the other hand, the flyback or return trace begins to show up badly and occupies a larger proportion of time interval between the forward traces. It tends to round off and distort the start and finish of the waveshape, so that it becomes impossible to view properly a single waveform. It is necessary instead to arrange several waveforms on the screen, as already mentioned, and base judgment on the inner waves only, these being unaffected by imperfections of the time base.

SIMPLE CIRCUITS

All simple time bases suffer from these limitations to a greater or lesser extent, and only in elaborate oscilloscopes can one expect to find time bases having better linearity or wider frequency range than already suggested.

A final point in this discussion is that two terminals and one switch appear on the panel of the R & H oscilloscope which are not seen on at least the simpler commercial instruments. The switch is marked "Ext.-Int. Sync." It is wired in the synchronising circuit of the sweep oscillator and selects the synchronising signal either from the horizontal amplifier, as already outlined, or from an additional terminal on the panel marked "Sync."

By raising the switch to "Ext. Sync." it is possible to lock the sweep oscillator in with any external signal, as for example the 50-cycle power mains. With this point in mind, a terminal is provided which carries a few volts of 50-cycle signal picked up from the power transformer. Such facilities are of secondary importance, however, and are not found on all oscilloscopes.

By way of example, by synchronising the time base to 50 c/s, hum tests on amplifiers are often expedited. It can also be used to advantage when comparing and calibrating audio frequency sources.

The controls on the larger 5-inch R & H oscilloscopes, described in the February, 1948 issue, are generally similar to those on the 3-inch CRO under discussion.

EXTRA TERMINALS

In the push-pull version of the 5-inch oscilloscope, however (March, 1948), additional terminals have been added to cater for the push-pull amplifiers, and the push-pull deflector plates. There are thus four sets of terminals and bridges instead of two sets, but their function remains unchanged.

Once the reader grasps the general idea behind oscilloscope connections, there is seldom any difficulty in "finding one's way" around a strange instrument.

Specialised and elaborate designs for radar, television and pulse work are a very different story, but these generally will not concern the average reader.

NEW MICROSCOPE USES X-RA

AN X-ray microscope, which makes visible the internal parts of materials opaque to light was announced last month by General Electric.

Future refinements of the instrument, which is still purely experimental, may result in sharper images and more magnification than possible with visible light. It may be able to compete with electron microscopes, with the additional advantage that specimens need not be enclosed in a vacuum.

At present, magnifications of 100 diameters have been obtained.

The unit operates on the principle that X-rays can be reflect polished surfaces if they s very small angles.

The apparatus consists of a tube and a pair of curved The rays strike the mirrors angle of less than one-half after passing through the sam

Like a convex lens acting light beam, the mirrors bend th so as to form a magnified imag photographic film.

The mirrors in the experime set-up are platinum-coated slabs fused quartz which can be curv by hand-controlled mechanic pressure to obtain best focus.

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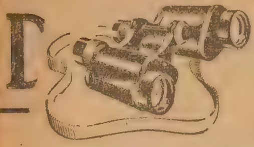

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As used to inflate rubber dinghies. Will hold many pounds of pressure. Approx. 12 inches long, 3 inches in diam., weight 3½lb. Sturdily constructed with screw top release valve.

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Or in 5-yard lengths **8/11**

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Blue Dungaree Drill Work Trousers

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One double-ended ring spanner, ½ x 9/16 SAE. One double-ended ring spanner 25/32 x ¾ SAE. One double-ended ring spanner ⅝ x 11/16 SAE. One double-ended ring spanner 1" x 15/16 SAE. One set spanner 15/16 x 1" SAE. One magneto set spanner OBA x 1BA. One magneto set spanner 2BA x 3BA. One magneto set spanner 2B9 x 4BA. One magneto set spanner ⅜ x 11/32. One magneto set spanner 9/32 x 5/16. One magneto set spanner ¼ x 7/32. One magneto set spanner 13/64 x 13/64. One metal tool box 3¾" wide x 7" deep x 15" long. All the above spanners are ex-Army. Brand new, and of the best quality.

The LOT for **£2/18/-**

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PURE WOOL, BRAND NEW ARMY TYPE GREY BLANKETS. 78 x 56ins. 3½lb. weight. Price, each **37/9**

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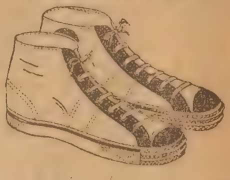
SANDBOOTS



These are brand new American pattern. Thick, spongy soles, renforced toe cap and are in two-tone effect. Three different colors: Blue, White and Brown. Ideal for gymnastics and general sports. Sizes 8 to 10. 25/- value.

Our Price, Pair **13/8**

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Machine Gun Reflector Gunsights

Ex-Air Force. Containing best quality lenses. Approx. 1½in. diam. 19/6 each.

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Ex-Navy, Brand New. Original price 8/6. These are Super Quality. Out they go.

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Ex-U.S.A. Air Force, Brand new. Liquid filled 3½" diameter x 3" deep. Made by Division of Bendix Aviation Corp., Bendix, New Jersey, U.S.A. Ideal for ships, small-craft, etc. Original cost £19/-/-.

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A genuine Oil Base Paint, extra good quality. Grey, Red Cream, White, Chocolate, Light Stone, Dark Stone, Mid Stone, Green.

1 Gallon Tin **£1/7/6**

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Please add 1/6 per Drum Cartage to Rail. Freight payable at your nearest Attended Railway Station.

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Brand New. Best quality tempered Steel, approx. 15 inches long. Ideal for scrub cutting, butchering and general utility knife. PRICE **6/6**

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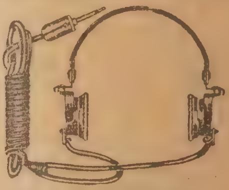

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Brand new S.T.C., complete with cord and plug.

2000 ohms Impedance **£1**

Suitable for crystal sets. Postage 1/6 extra.

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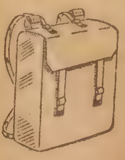

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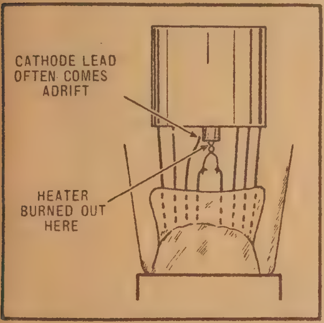
FROM THE SERVICEMAN WHO TELLS

**In a way, radio sets are just like people. Some respond immediatel
to a little attention, while others go on being cranky, no matter ho
much treatment you give to their insides. One of these days I'll hav
to compare notes with the local medico and get the material for
treatise on the subject.**

AFTER such a beginning, the reader will guess that I have a grouch, and I certainly have. It's disgusting how a little tuppeny-halfpenny mantel set can gum up the works.

It came in as dead as a doornail and, with an air of complete superiority, I plugged it in, switched on and watched for results inside the cabinet. Perhaps it was this air of assurance that the set objected to — I'll never know!

A few seconds after switching on, the rectifier lit up and burst into a beautiful violet glow which just about filled the envelope. A gassy rectifier —that was just peanuts to a man of my experience. Ho hum!



A heater fault in a 42 output valve stopped a mantel set. More common failure in this type of valve is a break in the cathode pigtail connection, as shown.

UNFORTUNATELY for my peace of mind, the new rectifier made no great difference to the end result. It certainly didn't flash and flare, but then the set didn't work either. Then I noticed that the heater of the 42-output valve was not glowing.

Closer inspection showed why. The heater wires had apparently shorted across just where they entered the cathode sleeve and I could see a mixture of charred powder and loose ends at this point. Either of two things could have happened.

INSULATION

The two heater wires are sprayed with some powdery "goo" to provide the insulation, and they are twisted into a spiral to slip inside the cathode sleeve. If the insulation fails and the heater wires short down near the bottom, the full voltage appears across a small fraction of the total heater length. As a result, it burns out in double quick time.

Alternatively, the heater may have shorted across to the cathode sleeve. Where the cathode is earthed, and likewise one side of the heater winding, it means that the full heater voltage appears, once again, across only a portion of the heater. The result is the same as before.

I haven't noticed any special weakness in the heaters of 42 output valves, although their cathode sleeves quite frequently come adrift from the internal connection. If a 42 or any similar output valve lights up normally but is completely dead, the chances are that the cathode is adrift internally.

In fact, you can often see the break just where the little tag is welded on to the bottom of the cathode sleeve.

I remember, some years ago, being stranded at a holiday resort with a mantel set which stopped suddenly at the beginning of a long week-end. You know — no shops open where radio valves could be bought.

Suspecting the output valve, I noticed that the cathode lead had broken away, rendering the stage very, very dead. With nothing to lose, I bumped the valve very solidly base first on the table and managed to shake the cathode sleeve down enough to establish contact with the tag. Every time the set stopped after that, the output valve got another bump.

NEW VALVE

But where am I getting to? Oh yes, I had a grouch.

Feeling a little sorry for the owner (hope I don't overdo this sentiment business), I duly plugged in a new output valve. But did that set go? No, sir, it remained as stubbornly silent as the grave. I should say it made plenty of humming noises, but nary a sign of a signal.

Rather than put up with the hum, I sorted out a couple of new electrolytics and connected them in parallel with the existing can types. These latter were supported on the speaker assembly of all places, but I found a spot for the new ones underneath the chassis.

The owner had entreated me not to spend more than necessary on the set, but I could never have let it go back humming like that. Sooner or later the hum would be commented on, the circumstances forgotten, but yours truly remembered as the last man who "fixed" the set. I've heard too many stories of compromise service jobs to take any risks.

It's a lot better, in principle, to have a client grumble over a high price for a good repair than to grumble over a bad repair for a low price.

Of course, the new electrolytics on this case didn't bring the stations to light, and I had to look further.

The screen and oscillator voltage were present and touching the meter prods on the various plate pins made plenty of clicks in the speaker. This is certainly not a very conclusive test, but it was at least a fair i
dication that there was not a co
plete stoppage in the IF channel.

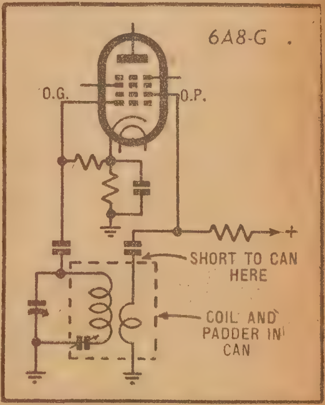
The natural impulse was to bla
the oscillator, and it was only a fe
moments work to unsolder the eart
end of the oscillator grid resistor a
check the grid current. It w
exactly nil, showing that the oscill
tor was not working. Quite often str
signals are heard in a superhet, ev
without the oscillator, but they a
invariably weak and out of positio

Not waiting to argue, I slipped
good valve into the socket, but wi
no better results. Ah, Hec . . .

UNUSUAL CIRCUIT

Turning the set over revealed a
unusual oscillator circuit. I can't r
number the exact details now, but
was something along the lines show
in the circuit. The point about it
that one winding is permanently
earth potential, while readings o
the other were upset by the padd
which was built inside the oscillat
coil can. There was nothing con
clusive, therefore, about the fact th
one winding showed continuity t
earth, and the other read as ope
circuit. This was where I began t
think rude words at the prospect o
having to strip out the coil and ca
With the ordinary circuit, a short is
short and no doubt about it.

Just then, I moved the chassis —
goodness knows what for—and ther
was a change in the background nois
Turning the dial brought in th
stations. I was very happy—I don'



An intermittent fault was traced to a short between the plate winding in a shunt-fed oscillator coil and the can. This circuit is a hard one to check, with an ohmmeter.

AMPLIFIER KITS

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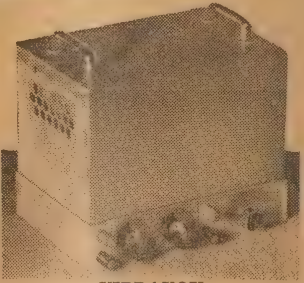

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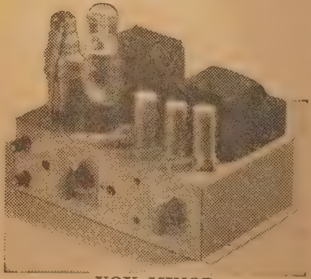

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think! Hard-to-get-at faults are bad enough without being intermittent as well.

Just when the outlook was blackest, I noticed that one of the terminating lugs on the oscillator coil was loose and very close to a metal binding ring round the centre of the coil assembly. A mere touch and the set would play or refuse to play, for it was simply grounding the plate side of the winding. It didn't take long to fix that.

Looking back, the failure of the 42 had obviously been the immediate cause of the stoppage. However, the 80 was on its last legs, and the moment the set was moved it had developed the fault in the oscillator. To be sure, troubles seldom come singly.

Anyhow, a spot of alignment, a further check over the wiring, and the set went back into its cabinet. My two-minute service job had stretched out into an hour or so.

Speaking of intermittent coils, &c., reminds me of another midget set which came in recently, the complaint being very high hiss behind all the stations.

On checking it over, the local stations were certainly not strong, even with a reasonable outside aerial in use. In point of fact, the set just behaved as if no aerial were connected to it at all.

INPUT CIRCUIT

It was fairly obvious that all was not well with the aerial input circuit. An open circuited primary is a common cause of such troubles, the exact effect depending on the nature of the coil and the position of the break. If the break is at the aerial end, just inside the can, the signals don't get very far at all. On the other hand, a break near the earthed end of the coil will often leave enough capacitive coupling to give passable results, even though the primary is not functioning as it should.

An open circuited winding is easily spotted with an ohmmeter, but a shorted winding is harder to find. Fortunately, with a low range ohmmeter and modern high impedance coils, there is enough resistance in the winding to show a difference from a dead short. Otherwise, it is a case for actual inspection.

On the secondary side, trouble can be caused either by an open or a shorted winding, or, more commonly, by a short across the mica trimmer. Gang condensers are seldom at fault these days. If the trimmer is wired directly across the coil, it is often necessary to unsolder one end to test for shorts. With an A.V.C. circuit and the trimmer earthed, the check can be made without resort to the iron.

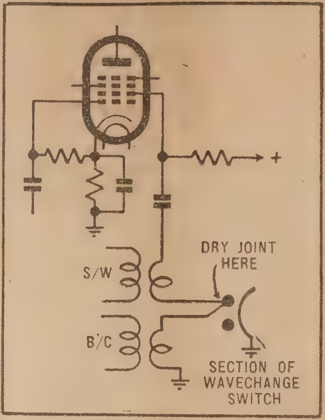
OPEN CIRCUIT

In this particular set, the issue was not in doubt for long, because a check of the aerial primary circuit showed that it was definitely open. Since there was nothing else for it, I removed the coil and extracted it from the can. Sure enough, the connection to the aerial lug had been pulled tight and had snapped.

Normally, this should not have happened, but the coil former was not properly cemented to the end fixtures, leaving it free to turn. During assembly, the former had pulled tight against the wires to the lugs and one of them had parted after the set was put into service.

Having got on to the subject of coils, I may as well finish on the same note.

A reader from Campsie, NSW, tells how a set went suddenly dead, apart from a few odd weak signals here and there on the dial. He rightly concluded that the trouble was in the oscillator section.



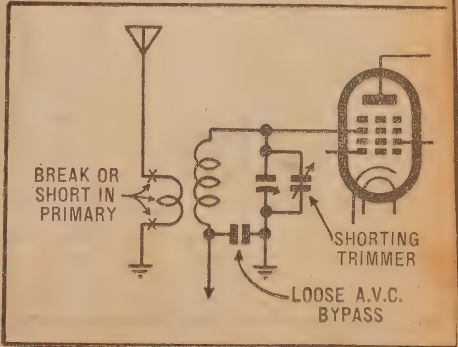
Another shunt-fed oscillator circuit, this time from a dual-wave reciever. A dry joint which opened the return from the short-wave coil rendered the oscillator inoperative on both bands.

Since it occurred simultaneously on both broadcast and short-wave, it looked like a faulty converter valve, but this tested as "good." Obviously, then, it had to be a component or circuit common to both bands.

Examination of the circuit showed that the coils were wired in series, the switch shorting out the broadcast coils for short-wave reception. The short-wave coils remained in circuit all the time, adding their mite of inductance and capacitance to the larger coils for broadcast work.

To be still more different, the oscillator plate was shunt-fed, so that a quick check with a multimeter might lead one to suppose that the plate circuit was necessarily in order.

In point of fact, the plate circuit was not in order, a dry joint having occurred at the point where the two coils joined a lug of the wave-change switch. In effect, therefore, there was no return circuit for the plate on either band, so that the o remained still and silent.



When connection to the aerial makes only a slight difference to a weak reciever, there may be a fault in the aerial coil or the associated circuits. Even bad misalignment can cause the trouble.

To change the subject rath lently, I have a friend who interested in records. In th have cause to wonder, firstl I have any friends and se that anyone can find time to these days and listen to mus

However, this friend has a commercial record changer ing with his set and fitted wi of the heavier style pickups. ous to conserve his record, asked me about a lighter- replacement head. I happen have one on hand and sug, that he take it away for a explaining that he could rather more brilliant respor little less bass from the ex amplifier and possibly a dif type of needle scratch.

THE RESULT

He duly reported back, sai liked the general tone balance found that the head tended to across the disc. I explained this was probably due to stif of the trigger mechanism unde arm and suggested careful in tion and oiling of the "works." was also to make sure that the t table was level and to try we ing the head with a penny.

He followed instructions but f that the penny was definitely ne sary, so that the saving in we over the old head was cance The new head could still offer creased compliance and there- save record wear, but was the ference worthwhile? I had to l him to work that one out for h self.

Record changers are excellent their way but many of the o models load the pickup arm rat heavily. A lightweight head wo rather skip grooves than push t hard.

That, I am afraid, is that! Hav recorded these words of wisdom must lay down the pen for scythe and go clear the paspal from the back door.

Actually, I added this final q to the last article, but the edi chopped it off to make room for ad. It still applies, however, becau the paspalum has grown again in t meantime. If only I could turn t stuff to commercial advantage, wouldn't have to worry about rac sets ever again.

COURSE IN TELEVISION

PART 13—VIDEO DETECTORS

laving disposed of I.F. amplifiers and learned something of their design, the next step is o examine the subject of video detectors. While closely allied with synchronising and gain control circuits, the fundamental requirements of the detector are not hard to follow.

EO transmissions employ amplitude modulation and the function le video detector in the receiver xactly similar to that in a conional broadcast set. It must sepe the modulation from the car- and then eliminate the carrier sideband components by means suitable output filter.

asically, therefore, it becomes ible to use any of the commonly wn A.M. detectors — grid leak, de bend, diode and so on. In ctice, the tendency thus far has n to favor the diode, for the same eral reasons which have led to its in broadcast receivers. The cirtry is simple, self-adjusting and dily adapted to provide d-c volts proportional to carrier strength.

GHER GAIN

ther circuits may provide greater n, but designers generally have eferred to obtain this elsewhere in e circuit.

Figure 1 illustrates a simple basic de circuit, involving a source of carrier input and a load resistor "R" across which the detector develops a voltage corresponding to the original modulation. It is assumed that the load resistor is bypassed by a condenser "C" intended to eliminate the carrier and sideband components.

In a normal broadcast receiver, the "carrier" is actually the intermediate frequency, and is usually at about 455 Kc. The highest modulation frequency does not exceed 15 Kc, even in an extreme case, giving a ratio of approximately 30: 1 between the unwanted and wanted components in the detector output.

The load resistor "R" normally has a value between 0.25 and 0.5 meg., while the bypass condenser may be .0001 mfd. At 455 Kc. the reactance of the condenser is only about 3500 ohms, so that it is fairly effective as an R.F. bypass. At the highest modulation frequency, however, the reactance is still greater than 0.1 meg, while it is of the same order as the load in the range of frequencies which represent the normal top limit of a broadcast receiver.

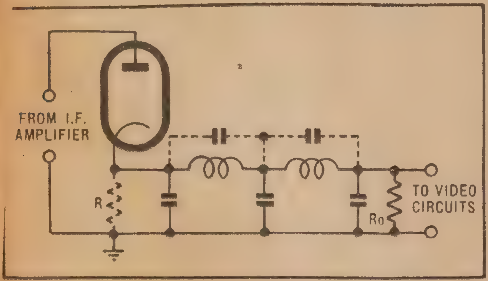


Figure 2. Diode circuit with low-pass output filter to suppress carrier and sideband frequencies.

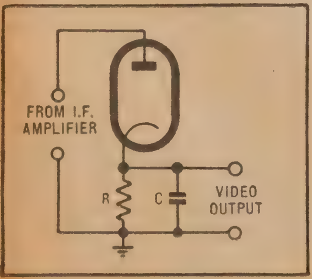


Figure 1. Basic diode detector circuit, giving a positive output pulse with increasing carrier power.

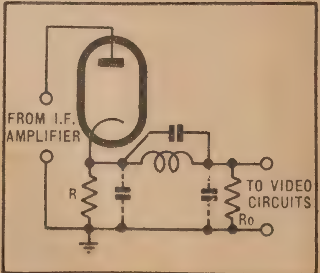


Fig. 3. An alternative type of filter, consisting of a circuit tuned to the intermediate or carrier frequency.

The designer may choose to add another stage of R/C filtering for more complete carrier suppression but, in any case, the normal circuit capacitances involved in the coupling to the audio stage confine the response largely to the audio spectrum.

The frequencies involved in a television receiver have a drastic influence on the choice of components. The carrier (that is the intermediate frequency) may be from 10 to 25 odd Mc., depending on the system, with superimposed modulation frequencies up to 4, 5 or 6 Mc. This is a very different story from broadcast receivers and the audio spectrum.

If the load "R" were to remain unchanged, condenser "C" would need to be extremely small to avoid a shunting effect on R at the highest modulation frequencies. A maximum of two or three pF. would be indicated.

CIRCUIT CAPACITANCE

This is out of the question, however, since the capacitances between heater and cathode, those in the wiring itself, and the input capacitance to the next valve together constitute a considerable whole, quite apart from any intentional R.F. bypass.

Since there is a practical limit below which the total shunt capacitance cannot be reduced, the only possible measure is to limit drastically the resistance of the load, so that it is normally lower than the reactance of the effective circuit "C" for all modulating frequencies. To satisfy this requirement it is necessary to use a diode load resistor in the order of 5000 ohms.

Unfortunately, a load resistance of this order approaches the internal resistance of a typical diode and detection efficiency drops sharply as a result. Furthermore, it is not easy to produce suitable diodes which have a low internal resistance.

For the circuit to operate correctly, the capacitance across the diode must at all times be much lower than the effective "C." If this is not so, the R.F. input voltage tends to divide capacitively between the diode and filter, rather than according to the resistance variations in the diode rectifier.

The diode cannot afford, therefore, to have anything more than the bare minimum of internal capacitance, otherwise it becomes necessary to increase "C," reduce "R" and sacri-

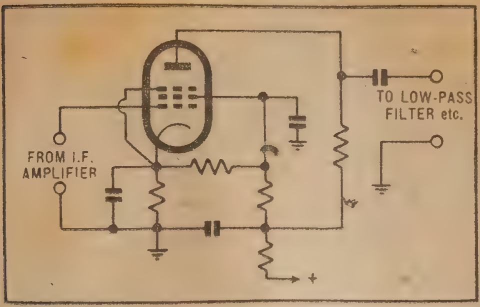


Figure 6. The circuit arrangement of an anode bend detector. Divider network substantially fixes the operating point.

fice the whole advantage of low diode resistance.

High Perveance — or low resistance — diodes have been developed especially for television service, but they merely ease the position without solving it. Wide bandwidth and stage gain remain as fundamentally opposed factors in the detector and other stages alike.

A further difficulty arises from the fact that there is a comparatively small difference ratio between the intermediate and the highest modulation frequency. The ratio may be only 4 to 1 or 5 to 1, as compared with about 40:1, for a wide-range broadcast receiver.

It follows that a filter condenser "C" small enough to have negligible effect on the modulation will not be very effective as a carrier bypass. Conversely, an effective carrier bypass condenser must necessarily attenuate the upper modulation frequencies.

An effective way of dealing with the situation is to replace the simple condenser "C" with a complete low-pass filter as shown in figure 2, which will pass the modulation frequencies without attenuation and block the intermediate frequency. While this may appear to be relatively simple on the surface, the position is often complicated by stray capacitances which tend to upset calculated figures.

R.F. FILTER

The filter may be one of several possible types and figure 2 should be regarded only as a general illustration.

In practice, the input resistance "R" disappears from the circuit, its function being taken over by the terminating resistance Ro. The condensers shown dotted may be physical components, or known wiring capacitances, or a combination of both. There is obviously much room for variation, according to the ideas of the designer.

Figure 3 indicates a somewhat different approach in which a series choke is resonated at specific frequency as, for example, the intermediate frequency or the carrier frequency in a TRF design.

Once again, the various capacitances may be a combination of stray and physical capacitors, the chokes being wound to achieve resonance in the particular circuit hook-up.

It might be assumed that the foregoing adds up to a chapter of reasons why the diode detector is unsatisfactory. In point of fact, however, precisely the same factors have to be considered with other forms of detector — low output loads and elaborate filter systems. Detector efficiency suffers and the distortion content rises at the same time.

Rightly or otherwise, it is claimed that non-linearity in a video detector is much less serious than the same effect in an audio channel. In the one case, the result is obvious and objectionable distortion. In the other, it results in a certain and often unnoticed variation of balance between light and shade, with perhaps tion in the height of synch pulses.

Whether this view will con be tolerated as the art devel mains to be seen.

For the sake of record, variations from the simple dio be noted. Figure 4 shows tl nections for a voltage doubli tem which is sometimes used set the loss in output due values of "R." The circuit finc frequent application in re which dispense with video sta feed the detector output stra the intensity grid of the catho tube.

It has the disadvantage that be fed from a balanced IF former, whereas the simpler can be fed, if necessary, from a anode circuit through a couplin denser.

PUSH-PULL DIODES

Yet another variation is sho Figure 5, which shows a pus diode detector. If properly anced, the circuit substantially cels the carrier component i diode load, thereby simplifyin problem of filtering.

(Continued on Page 85)

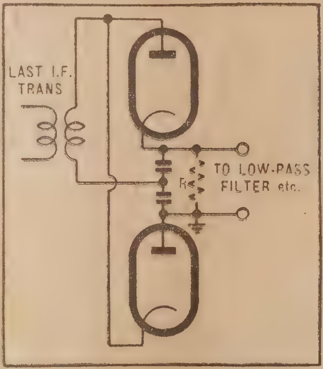


Figure 4. A typical voltage-doubling detector used where high output voltage is required for direct feed to picture tube.

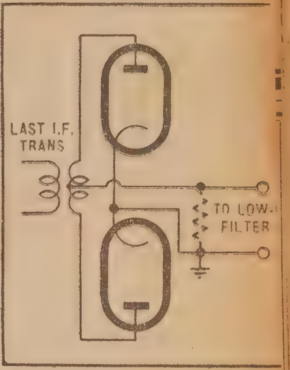


Figure 5. A push-pull diode detect Chief advantage is cancellation carrier component, thus simplifyi R.F. filter.

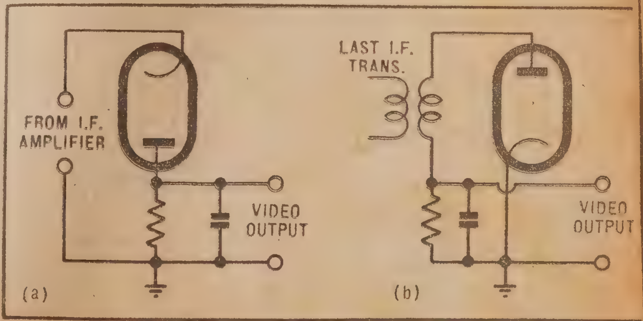
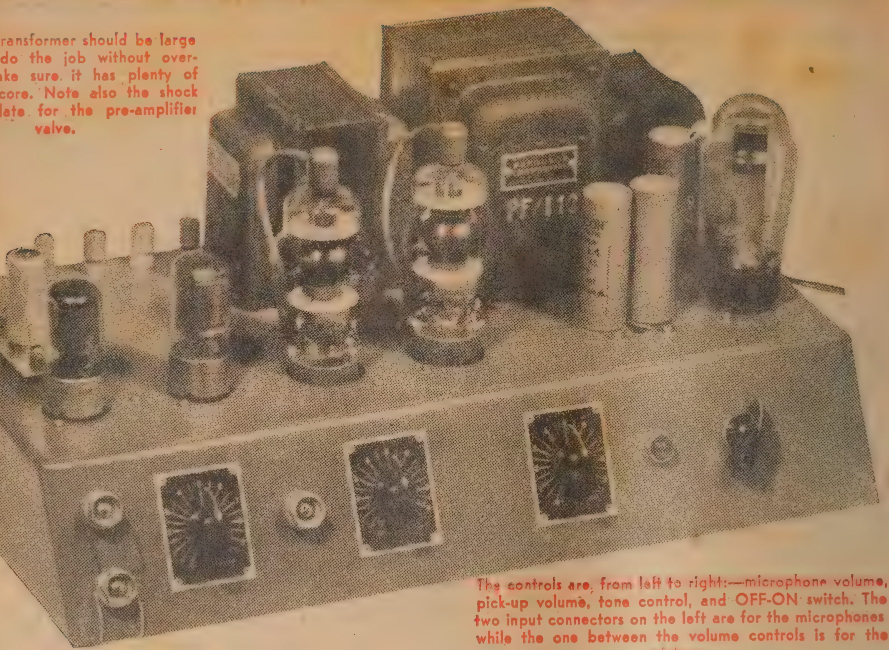


Figure 7. Alternative circuit arrangements which reverse the polarity of detecto signals, giving negative output for increasing carrier.



ıtput transformer should be large h to do the job without over-. Make sure it has plenty of n its core. Note also the shock ng plate for the pre-amplifier valve.

The controls are, from left to right:—microphone volume, pick-up volume, tone control, and OFF-ON switch. The two input connectors on the left are for the microphones while the one between the volume controls is for the pick-up.

0-WATT P.A. AMPLIFIER

ising standard components throughout, this amplifier has been especially designed for igh power public address and factory paging systems. It has one pick-up and two microphone channels and a multi-ratio output transformer to feed a variety of speaker lines.

ILE high powered amplifiers have much in common with ulators—in the amateur sense— e are, nevertheless, several basic erences.

ıe input circuits of a public ads amplifier must have at least pickup and one microphone nnel. This latter must have a rve of gain over that normally vided in a modulator to cope with ering platform and stage techıes. Channel mixing is a special antage.

AD CONDITIONS

hen, too, a public address amplimust be capable of operating into ighly reactive, and often a mistched load without undue distor- and this generally means the vision of feedback.

Vhile many jobs can be done with aller equipment, most public adss operators look upon a 30-watt plifier as the best all-round prosition. It does not involve an undue tlay for parts or valves and there very few tasks—indoor or outor—which it cannot cope with.

The amplifier to be described be- fulfills all normal requirements. It will deliver 30 watts of sine wave output and over 40 watts on voice peaks before any distortion is apparent. If you are willing to tolerate a certain amount of distortion, as is not uncommon in PA work, powers even higher than 40 watts can be obtained on voice peaks.

The amplifier has three input circuits. Two of these are wired in parallel to allow twin microphones to be used.

The main disadvantage of this scheme is that the microphones must be of the same type. A crystal type cannot very well be paired with a dynamic or a velocity, for instance. However, this disadvantage is not of great importance and certainly does not outweigh the convenience of having two input channels available should these be necessary.

by Derrick Williamson

On a wide platform, both microphones can be used while, for offstage effects, the extra unit is simply plugged in or removed as required.

The valve chosen for the microphone preamplifier is one of the newer miniatures, type 6AU6. It was selected because it provides high stage gain and more freedom from hum and microphonic troubles than the larger valves.

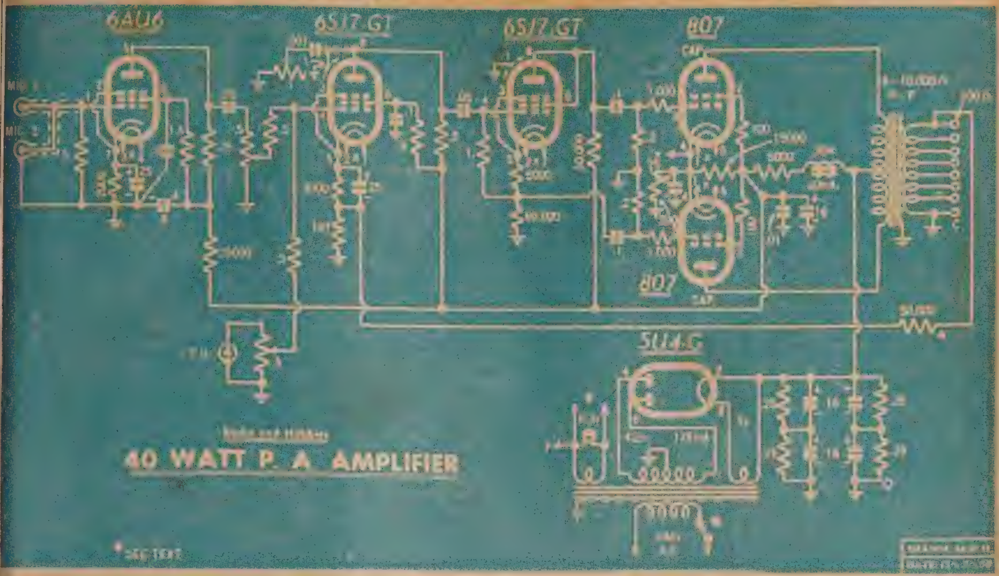
SHOCK MOUNTING

To further reduce the chance of acoustic feedback and microphonic noises the valve was mounted on a small metal plate, which in turn was mounted on live rubber grommets. This allows the whole valve assembly virtually to float and greatly reduces noises caused by vibration, &c. It is important, however, to make the connections to the socket with very flexible wire.

In our case we mounted two small bakelite tag strips, one on each side of the socket, under the chassis. Connections were made from the valve socket to the strips with flexible wire and the components were soldered to the strips.

At this point we could well con-

CIRCUIT PROVIDES MIC. AND PICKUP CHANNELS



The circuit is quite straight forward. Note the mixing system and the method of applying negative feedback. The H.T. filtering is also of interest.

sider the hum troubles which can occur due to heater cathode leakage or heater cathode emission within the valve. Some of these high gain valves vary a good deal in this respect and it is not at all uncommon to find that one new valve may cause more hum than another. Sometimes a valve which was quite good when new will gradually develop a noticeable hum and yet, when used in a circuit operating at a higher level, it will cause no trouble at all.

The particular treatment we have used in this PA amplifier, is that of insulating all the filament wiring from earth, including the panel lamp, and returning the heater network to a positive point in the circuit.

POSITIVE RETURN

The filaments are actually returned to the cathodes of the output valves, which are approximately 25 volts positive with respect to earth.

The microphone preamplifier provides more than adequate gain for use with the popular crystal and high impedance dynamic microphones.

It will be necessary to use some shielded wire in the assembly of the microphone pre-amplifier and mixer circuits, and we recommend that you use the small diameter co-axial cable known as type PT1M.

The shielded wire connected to the tone control should be of the ordinary high capacitance type, as it also functions as a high frequency bypass condenser from the plate of the voltage amplifier to earth. If low loss cable is used here it will be necessary to wire a 50 or 100 pF condenser from the voltage amplifier plate to earth.

Approximately 9in. of shielded wire will give the correct capacitance and this should be covered with a peice of spagetti tubing and earthed at the end connected to the valve. The earth connection to the tone control can be made to the shielded wire.

At this point it is well to remind readers again that in high gain amplifiers, all the earth returns for the pre-amplifier stage should be to the one point, even if this means insulating some of the components from earth and connecting them to the common point with hook-up wire. This is most important and, coupled with good filtering, is responsible for the low hum level of the amplifier.

The amplifier is so quiet that the

PARTS LIST

1 Chassis 17" x 8½" x 3".
1 Power transformer 425V-425V 175 mA, 6.3 V. 3 A., 5 V. 3A.
1 Filter choke 30H., 60 mA., d-c. resistance approximately 450 ohms.
1 35 Watt output transformer 10,000 ohms plate to plate to 500 ohm tapped secondary.
4 Octal valve sockets.
2 5-pin valve sockets.
1 7-pin miniature valve socket, complete with shield.
1 Dial lamp holder and bezel (insulated type).
3 Pointer Knobs.
1 Semi-rotary Off-On switch.
3 Engraved plates for controls.
3 Input connectors (shielded type).
1 Octal Plug.
4 Terminals (different colors).

VALVES

1 6AU6, 1 5U4-G, 2 6SJ7-GT, 2 807.

RESISTORS

1 5 megohm.
1 3 megohm.
1 1.5 megohm.
1 1 megohm.
1 1 megohm potentiometer.
3 .5 megohm.
2 .5 megohm potentiometers.
5 .25 megohm.
2 .2 megohm.
3 .05 megohm.
1 .025 megohm.
1 15,000 ohm 20 watt wire wound.
1 5000 ohm.
1 5000 ohm 20 watt wire wound.
1 3000 ohm.
1 2000 ohm.
2 1000 ohm.
1 200 ohm. 20 watt wire wound.
2 100 ohm. 1 watt carbon.
1 100 ohm.

CONDENSERS

3 25 mfd 40 P.V. electrolytic.
5 16 mfd 525 P.V. electrolytic.
1 8 mfd 525 P.V. electrolytic.
4 .1 mfd tubular. 400V.
2 .05 mfd tubular. 400V.
1 .01 mfd tubular. 600V.
1 .001 mfd mica.

SONDRIES

Nuts and bolts, solder lugs, solder, hook-up wire. 1ft. shielded wire, 1ft. 6ins. PT1M co-axial cable, 2 insulated plate cap connectors, resistor mounting strips, spaghetti tubing, 4 rubber grommets (gang mounting type), 3 ⅜" dia. rubber grommets, scrap of aluminium for 6AU6 mounting plate, power cord and plug, 6.3 volt dial lamp etc.

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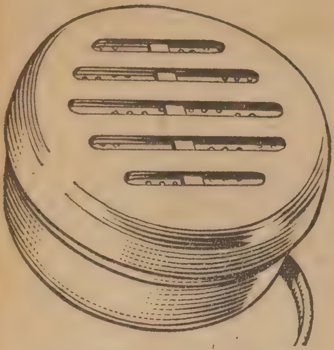

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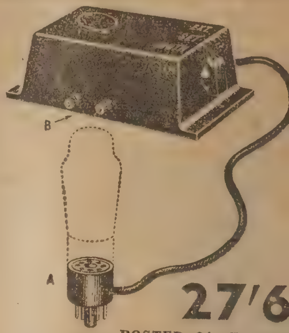

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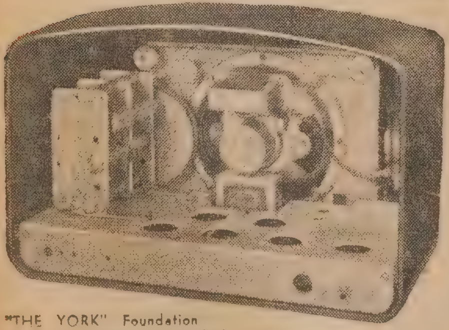

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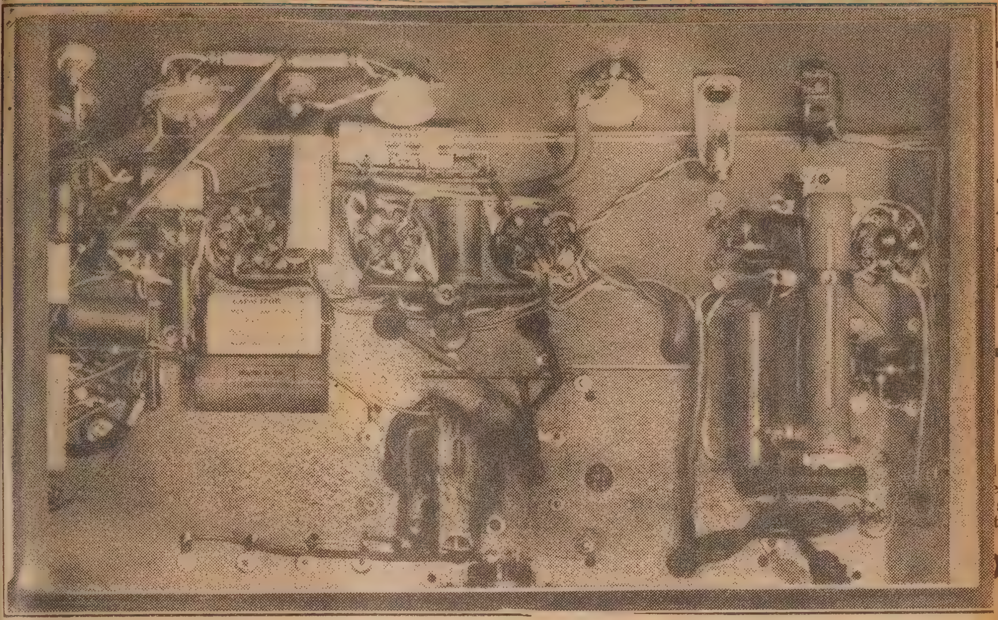


All the major components can be seen from this photograph. Note the 50 watt adjustable resistor used for obtaining the screen voltage. This can be replaced by fixed resistors if desired.

valve noise overrides the hum level with the microphone input short circuited and the gain control fully advanced.

The third channel on the amplifier is provided for use with a pickup. The pickup and microphone preamplifier are connected to the amplifier through a resistance type mixer or fader.

The input required for full output at the pickup connector is approximately 0.8 volt.

The valve used for the voltage amplifier stage is a 6SJ7-GT. This is operated with high plate and screen resistors to achieve as much gain as possible, partly to make up for the loss in the mixer circuit, and partly to allow about 10db of negative feedback to be applied.

PHASE CHANGER

Next stage in the phase changer which uses the well tried cricuit employing equal cathode and plate load resistors. Here again a 6SJ7-GT valve was used, this time connected as a triode. However, any general purpose triode could be used equally well in this position.

The output valves selected are 807 types. These valves will easily deliver the required output, and can be operated with high voltages.

You will notice that the grid resistors used are lower than we normally specify. This is because some of the disposals valves we tried exhibited grid current tendencies when operated under the high plate voltage conditions shown in the circuit.

The use of low grid resistors and a screen voltage that does not exceed 300 volts (screen to cathode) completely prevented the tendency for the valve to draw excessive current.

We have used the conventional grid and screen stoppers to prevent parasitic oscillation. Our own amplifier was perfectly stable even at full output.

The screen voltage is obtained from the HT through a series dropping resistor and filter choke. A bleed resistor is connected from this point to the cathodes of the output valves and this helps to stabilise the screen voltage and the bias. HT for the voltage amplifier stages is also taken from this point.

The electrolytic condenser used here is a 16 mfd and this high capacitance helps to maintain a high screen voltage during voice peaks. With sine wave input, the screen voltage drops to about 260 volts, which accounts for the decrease in output under these conditions.

The sine wave power output could be increased by using a 200 mA power transformer and a much heavier bleed resistor to improve the regulation of the screen voltage, but this would mean extra outlay to satisfy an academic point.

SCREEN DIVIDER

The circuit shows two resistors used as a divider across the supply but actually we used a large 20,000 ohm 50 watt adjustable resistor. This has the advantage of allowing the screen voltage to be easily adjusted, but please yourself which you use. The adjustable resistor may not be so easy to obtain as the two smalle resistors, although it is really to b preferred.

The cathode bias resistor shown i the underneath photograph is of th five-watt type. A simple calculatio however, will show that the actua dissipation heat is about 3.5 watt This is too high for a five-wat resistor used in a confined space an we have, therefore, specified the nex largest available size, which is th twenty-watt type.

FILTER CHOKE

The filter choke shown connecte in series with the screen droppin resistors provides the major part the filtering for the voltage amplifiers. It should have a 60 mA curren rating and an inductance of 3 henrys on load. The resistance of th choke we used was 420 ohms. An large variation in the d-c resistanc of the choke used here will alter th screen voltage slightly, but if th variable resistor is used for the scree feed, this can quickly be adjusted.

Parasitic suppressor resistor should be mounted right on the valv socket tags and the small .01 mf bypass should be mounted at th junction of the two resistors. W actually mounted a small insulate pillar to the chassis between the tw valve sockets. The junction of th two resistors and the bypass condensers were soldered to a lug at th pillar and the other ends of the resistors were anchored at the valv sockets themselves.

Plate leads to the output valve come through two grommets in th

STANDARD FERGUSON RANGE

POWER & VIBRATOR TRANSFORMERS

	A.C.	Vib.				Retail
PF 122	240	6	220	40	6.3V @ 2A	33/6
PF 125	240	6	250	60	6.3V @ 2A	43/-
PF 119	240	6	325	125	6.3V @ 4A	62/-
PF 182	240	12	200	40	12.6V CT @ 1A	33/6
PF 126	240	12	250	60	12.6V CT @ 1A	47/6
PF 146	200,30,40	12	325	150	12.6V CT @ 2.5A	67/-

FILTER CHOKES

	Induct	D.C. Res.	M.A.	
CF 100	50	1900	10	18/-
CF 101	30	870	25	18/-
CF 102	15	300	60	12/-
CF 103	30	420	60	26/-
CF 104	30	580	75	31/-
CF 105	15	250	80	24/-
CF 106	12	200	100	24/8
CF 107	30	360	100	34/8
CF 108	12	135	150	35/-
CF 109	20	225	150	37/8
CF 110	12	100	200	43/8
CF 111	16	165	200	45/10
CF 112	10	70	250	46/2

SPECIAL CHOKES

CF 113	.5	70	250		
	20		50	Swinging choke	50/6
CF 114	1.1	23	375	Ballast choke	24/-
CF 115	.017	.6	2 amps	L.T. choke	10/-

OUTPUT TRANSFORMER TO VOICE COIL

Full Frequency Range (30-15000)

Code No.	Pri. Imped.	Sec. Imped.	Watts	Retail
OP24	5000 SE	8.4, 2.1, with feed back	5	44/10
OP23	3250 SE	12.5, 8.4, 2.1	10	65/1
OP19A	5000 PP	12.5, 8.4, 2.3	15	102/10
OP51	4500 PP	15.5, 12.5, 8.6, 2.8, 2	20	36/9
OP63	10000 PP	15, 3.75	15	100/-
OP64	10000 PP	12.5, 3.125	15	100/-
OP65	10000 PP	8.4, 2.1	15	100/-

OUTPUT TRANSFORMER TO VOICE COIL

Special Full Frequency (20-30,000)

OP25/40	10000 PP	40, 10	15	130/-
OP25/16	10000 PP	16, 4	15	130/-
OP25/15	10000 PP	15, 3.75	15	130/-
OP25/12	10000 PP	12, 3	15	130/-
OP25/10	10000 PP	10, 2.5	15	130/-
OP25/8.4	10000 PP	8.4, 2.1	15	130/-
OP66	5000 PP	8.4, 3.7	15	130/-
OP67	5000 PP	15, 6.5	15	130/-

OUTPUT TRANSFORMER TO LINE—

Full Freq. Range.

OP22	3250 SE	500, 125, 8.3	10	65/1
OP19b	5000 PP	500, 250, 125	15	102/10
OP21	8000 PP	500, 250, 125	15	82/10
OP62	10000 PP	500, 125	15	100/-

OUTPUT TRANSFORMER TO LINE—

Special Full Freq. Range

OP25/500	10000 PP	500, 125	15	130/-
OP25/250	10000 PP	250, 62.5	15	130/-

VIBRATOR TRANSFORMERS

Code No.	Pri. V.	D.C. Out.	MA	Buffer Full Sec.		
VT 100	32	200	40	.005	Sync.	27/-
VT 101	6	90	15	.008	”	19/6
VT 102	6	150	25	.005	”	23/10
VT 103	6	200	50	.005	”	25/-
VT 104	6	250	60	.005	”	37/-
VT 105	12	250	60	.005	”	37/-
VT 106	6	300	75	.008	”	52/-
VT 107	6	250	60	.005	Sync. Low Rad.	30/6
VT 108	12	90	15	.008	Sync.	21/8
VT 109	24	90	15	.008	”	23/8
VT 110	12	150	25	.005	”	23/10
VT 111	24	150	25	.005	”	26/6
VT 112	12	200	50	.005	”	25/-
VT 113	24	200	50	.005	”	26/6
VT 114	12	300	75	.008	”	54/2
VT 115	24	300	75	.008	”	55/6
VT 116	24	250	60	.005	”	30/-
VT 117	12	250	60	.005	Non Sync. Low Rad.	31/-
VT 119	32	150	25	.005	Sync.	25/6
VT 121	6	180	30	.005	”	25/4
VT 122	6	400	50	.005	”	50/-
VT 123	12	320	125	.005	Sync.	63/3
VT 124	32	250	60	.005	”	30/-
VT 127	6	200	50	.005	Sync. Low Rad.	29/8
VT 128	12	250	60	.005	Sync. Low Rad.	38/-

RECEIVER POWER TRANSFORMERS

Code No.	Prim.	HTV Aside	M.A.	Filaments	Retail
PF 185	240	150	50	6.3V @ 2A	24/-
PF 106	240	325	45	6.3V @ 2A, 5V @ 2A	30/-
PF 198	240	285	50	6.3V @ 2A, 5V @ 2A	30/-
PF 151	200,30,40	285	60	6.3V @ 2A, 5V @ 2A	34/-
PF 165	200,30,40	385	60	6.3V @ 2A, 5V @ 2A	34/-
PF 170	200,30,40	285	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 168	200,30,40	385	80	6.3V @ 2A, 6.3V @ 2A, 5V @ 2A	39/10
PF 130	200,30,40	285	100	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	46/-
PF 160	200,20,40	385	100	6.3CT @ 2.5A, 6.3V @ 2A, 5V @ 2A	46/-
PF 152	200,30,40	285	125	6.3CT @ 3A, 6.3V @ 2A, 5V @ 2A	56/-
PF 181	200,30,40	385	125	6.3CT @ 3A, 6.3V @ 3A, 5V @ 2A	66/-
PF 174	200,30,40	285	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 2A	60/-
PF 175	200,30.40	385	150	6.3CT @ 2A, 6.3V @ 2A, 5V @ 3A	70/-
PF 173	200.30.40	425	175	6.3CT @ 3A, 6.3V @ 2A, 5V @ 3A	110/-
PF 140	200,30,40	385	200	6.3CT @ 3A, 6.3V @ 3A, 5V @ 3A	111/-
PF 171	200,30,40	385	250	6.3CT @ 4A, 6.3 @ 3A, 5V @ 3A	144/-

LINE TO VOICE COIL TRANSFORMERS

	Pri. Imped.	Sec. Imped.	Watts	
MT111	500	12.5, 8, 2.3	10	36/9
MT100	600	4. 3	15	36/9
MT101	500	15	15	36/9
MT124	600, 500	4. 3, 2.7, 2.3, 2	25	66/-
MT125	600, 500	15, 12.5, 8.4, 6.5	25	66/-

MODULATION TRANSFORMERS

MT118	8000, 6000 PP	10000, 7000, 5000	25	85/-
MT119	8000, 6600, 3800 PP	1000, 7500, 6500, 5500, 4500, 3500.	50	111/-
MT120	500 to 20000 in steps.	500 to 30000 in steps.	50	200/-
MT121	500 to 20000 in steps.	500 to 30000 in steps.	125	276/-

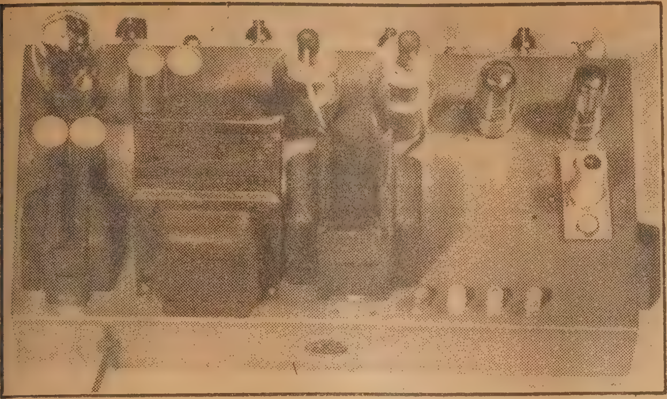
Output Transformer To Voice Coil—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1	5000, 2500 SE	12.5. 8. 2.3	10	39/10
OP54	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	10	45/8
OP39	5000, 2500 SE	15	10	39/10
OP33	5000, 2500 SE	5. 2.7	10	39/10
OP41	5500 SE	3.7	10	46/-
OP53	30000, 20000 14000, 10000. 7000 5000, 2500 PP	2.3	10	36/9
OP2	5000 PP	12.5. 8, 2.3	15	65/1
OP55	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP3	6600 PP	12.5. 8. 2.3	15	65/1
OP56	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7. 2.3, 2	15	73/10
OP4	10000 PP	12.5. 8, 2.3	15	65/1
OP57	10000 PP	15. 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	15	73/10
OP5	10000, 6600, 5000 PP	12.5, 8, 2.3	15	65/1
OP58	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3 2.7, 2.3, 2	15	76/2
OP59	10000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	25	93/8
OP60	10000. 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	32	116/8

OUTPUT TRANFORMER TO LINE—P.A. Range

	Pri. Imped.	Sec. Imped.	Watts	Retail
OP1A	5000, 2500 SE	500	10	39/10
OP44	5000, 2500 PP	500, 250, 125	10	47/-
OP34	5000 PP	600, 300, 200, 150, 130, 100 75, 50	15	81/4
OP6	5000 PP	500, 250, 125	15	65/1
OP7	6600 PP	500, 250, 125	15	65/1
OP50	8000 PP	600, 300, 120, 60, 30	15	126/-
OP8	10000 PP	500, 250, 125	15	65/1
OP8M	10000 PP	500, 250, 160, 125, 100, 83.5 71.5, 62.5, 55.5, 50	15	71/3
OP9	10000, 6600, 5000 PP	500, 250, 125	15	65/1
OP10	5000 PP	500, 250, 125	25	81/10
OP11	6600 PP	500, 250, 125	25	81/10
OP38	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	25	140/-
OP12	10000 PP		25	81/10
OP13	10000, 6600, 5000 PP	500, 250, 125	25	81/10
OP35	10000, 6600 PP	500, 4000, 8.4, 2.2	25	120/-
OP14	5000 PP	500, 250, 125.	32	102/10
OP48	6600 PP	140. 70.	32	117/8
OP15	6600 PP	500, 250, 125	32	102/10
OP15M	6600 PP	500, 250, 166, 125, 100 83.5, 71.5, 62.5, 55.5, 50	32	104/1
OP16	10000 PP	500, 250, 125	32	102/10
OP17	10000, 6600, 5000 PP	500, 250, 125	32	102/10
OP36	3800 PP	17.6	60	108/7
OP18	3800 PP	500, 250, 125	60	108/7
OP61	3800 PP	100, 75, 25. 10, 5, 2	60	133/8
OP37	6400 PP	500, 250, 125	80	150/8
OP49	8800, 6000 PP	500	105	210/-
OP20	11600, 8400 PP	500. 250, 125	150	276/-

A REAR VIEW OF THE CHASSIS



The octal output socket and output terminals can be clearly seen in this photo. Note the husky power transformer and relatively small filter choke. The series parallel electrolytics are mounted above spare valve holes in the chassis.

chassis and are anchored to two strip. The corresponding leads to lugs on a small resistor mounting the output transformer are soldered to these same tags. Don't cut these leads from the transformer too short. It might be necessary to reverse them if the amplifier oscillates when the feedback resistor is connected.

The output transformer itself is a very important link in the chain and, if an inferior component is used here, many watts of hard won power output will be thrown away due to mismatch or losses.

OUTPUT LOAD

We carried out a number of experiments with different load impedances to determine the correct load for optimum power output. This proved to be about 8000 ohms for the particular plate voltage used. The power measured across this load under ideal conditions with a regulated screen voltage and sine wave input was 43 watts before the grid current point was reached. However, this falls to about 30 watts if the screen voltage is not regulated. Note that the higher output will still be achieved on peaks due to the reservoir effect of the filter condensers.

If it is found difficult to obtain an 8000 ohm transformer, a 10,000 ohm type can be used with very little loss in power output. Do not use a 6600 type of transformer if you can avoid it. Our test showed that the power output dropped from 30 watts to 24 watts when the load was changed from 10,000 ohms to 6600 ohms.

Secondary impedances will depend on the class of work for which the amplifier is to be used. Our transformer has a 500 ohm winding with ten tappings. This allows up to ten 500 ohm speakers to be operated in parallel if required or a much larger number of speakers could be operated in series-parallel if necessary.

The system of using a 500 ohm output transformer and speakers fitted with small 500 ohm transformers has much to recommend it for PA work. Wires can be run for long distances without fear of resistance losses occurring in the cables. At the same time the impedance is low enough for cable capacities to have a negligible effect on the frequency response.

On the other hand the use of a transformer matching directly to voice coil is less expensive from the installation point of view, provided long cable runs are not required. Heavy cables must be used but the speaker transformers with their attendant insertion loss and extra cost are not required.

The final choice of output transformers must, therefore, rest mainly on the use to which the amplifier is to be put. Remember that it is better to spend the extra money on a good quality component and get the maximum available power from the amplifier.

As mentioned before, our transformer had ten secondary tappings which we anchored to small tag strips. Three of the most commonly used impedances were then connected to the four terminals which can be seen in the photograph. An octal socket was mounted on the chassis to which any impedance or combination of impedances could be connected to suit possible fixed installations.

SIMPLE FILTERING

You will notice that the filtering is very simple, consisting of a single 16 mfd input condenser. This condenser is made up of four 16 mfd 525v electrolytics connected in series-parallel with equalising resistors across them. The voltage at this point is approximately 500 volts and is above the safe working voltage, even for 600 volt electrolytics.

The small amount of filtering used is adequate in practice. In fact, one commercial manufacturer has used this type of circuit for a number of

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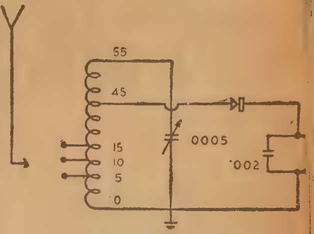

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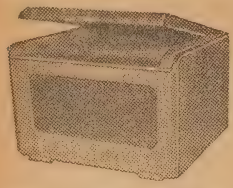

RADIOGRAM CABINETS

Walnut piano finish radiogram cabinet, suitable for 4 or 5 valve table radiogram. As illustrated, £7/19/6.

RECORD CHANGER BARGAIN

English Record Changers. Brand new. Plays 8 records, 10" and 12" mixed. Reduced from £18/10/- to £10/19/6 complete.

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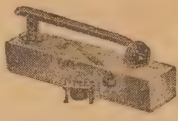
The new "Zepher" Hand Sprayer has hundreds of uses. As illustrated, small size; 24/6; large size, 26/6.

BATTERY CHARGER KIT

Kit of parts to build a 6 volt 4 amp Battery Charger. Kit includes an English Selenium Rectifier, transformer, black crackle finish metal case, 2 terminals, hook-up wire and circuit blueprint instruction. 12 volt, 5/- extra. Price, as illustrated, £4/10/-.

DISPOSAL BARGAIN

12 Volt 500 watt generators. Completely reconditioned. Ideal for home lighting plants. Price, as illustrated, only 10 gns.



HIGH FIDELITY PICK-UP BARGAIN

English Shefi High Fidelity Moving Coil Pick-Up. Complete with matching transformer. As illustrated. Reduced from £4/19/- to only 59/6.

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Pocket type dual reading moving coil. English Electrix test meters. 0-20V, 0-200V, scales. 200 ohms. per volt. Complete with leads. 15/-.

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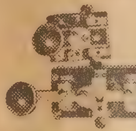
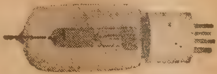


MORSE KEYS

Morse Key Bargains. Brand new Army type Morse keys. Small type, as illustrated, only 1/11. Large type, as illustrated, only 2/11.



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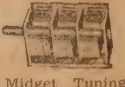
Type 35TG	£4/12/6
Type RX21	£4/9/-
Type KY21	£5/17/-



BARGAIN TUNING CONDENSERS.

Midget Tuning Condensers complete with trimmers, 2 gang, reduced to 8/11. 3 gang, reduced to 12/11.

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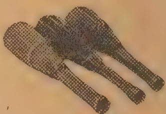

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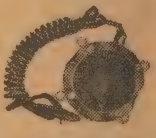

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English D.104 High Fidelity Crystal Microphones. As illustrated, only £4/19/6.

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years. The hum voltage is applied in phase to the plates of the output valves and balances out in the output transformer. This is another reason why a good quality output transformer with well balanced winding should be used.

The rectifier choosen is the 5U4-G, the voltages and current drain being well within its ratings. It is a somewhat more robust valve in our estimation than the new 5R4-GY.

While on the subject of rectifiers it would be a good idea to include a .5 amp fuse or a panel lamp in series with the H.T. C.T. of the transformer. With a power supply of this size a short circuit can melt the rectifier filament in a few seconds We know from experience!

FEEDBACK CIRCUIT

When designing this amplifier we envisaged taking the negative feedback voltage from one of the 807 plates to the screen of the voltage amplifier valve. This method is efficient, easy to apply and saves one or two components, it also makes the feedback loop independent of the output transformer secondary impedance.

Due to the simple power supply filtering, however, we were unable to use this method of feedback because of hum injection into the screen circuit of the voltage amplifier. The only alternative therefore was to connect the feedback loop to the transformer secondary.

This method of applying feedback is very satisfactory and gives extremely good frequency response due to the inclusion of the transformer within the feedback loop. The main objection is that the resistor used has to be adjusted for different transformer secondary impedances In practice the resistor is connected to the highest impedance tap and adjusted to give the desired 10 db of feedback. Connecting speakers to other taps will then not alter the feedback factor providing a serious mis-match does not occur.

SERIES RESISTORS

The 50,000 ohm resistor shown is correct for the 500 ohm line. The calculated list below gives suitable values for use with other impedances:

The resistance required for a transformer with a secondary of 250 ohms is 35,000 ohms, for 125 ohms is 25,000 ohms, for 15 ohms is 8500 ohms, for 12.5 ohms is 7700 ohms. for 8 ohms is 6250 ohms, and for 2 ohms is 3100 ohms.

The amplifier was built on a chassis originally designed for the Radio and Hobbies "6/240 Amplifier" which was described in the February and March, 1948, issues of the magazine. The only alterations made to the chassis was the provision of new mounting holes for the larger transformer and output transformer and the punching of a hole for the miniature preamplifier valve. Several small holes were also drilled to facilitate the mounting of small resistor strips, &c.

Well, that just about concludes the description of our latest amplifier Carefully built it should do all that is claimed of it and should give long, trouble-free service.

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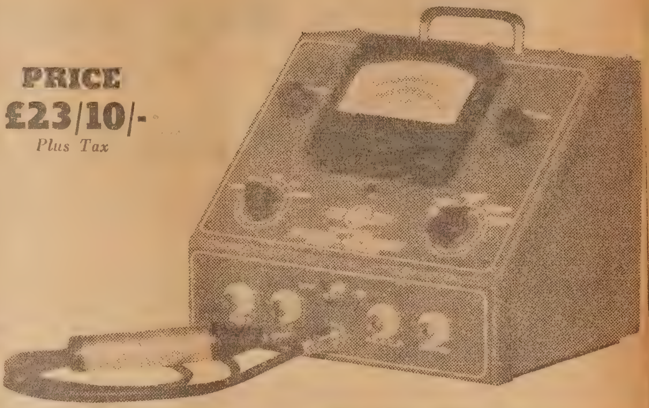

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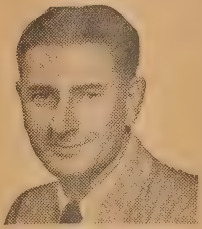

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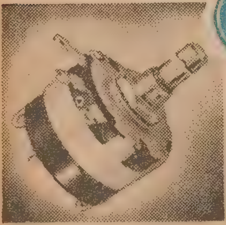

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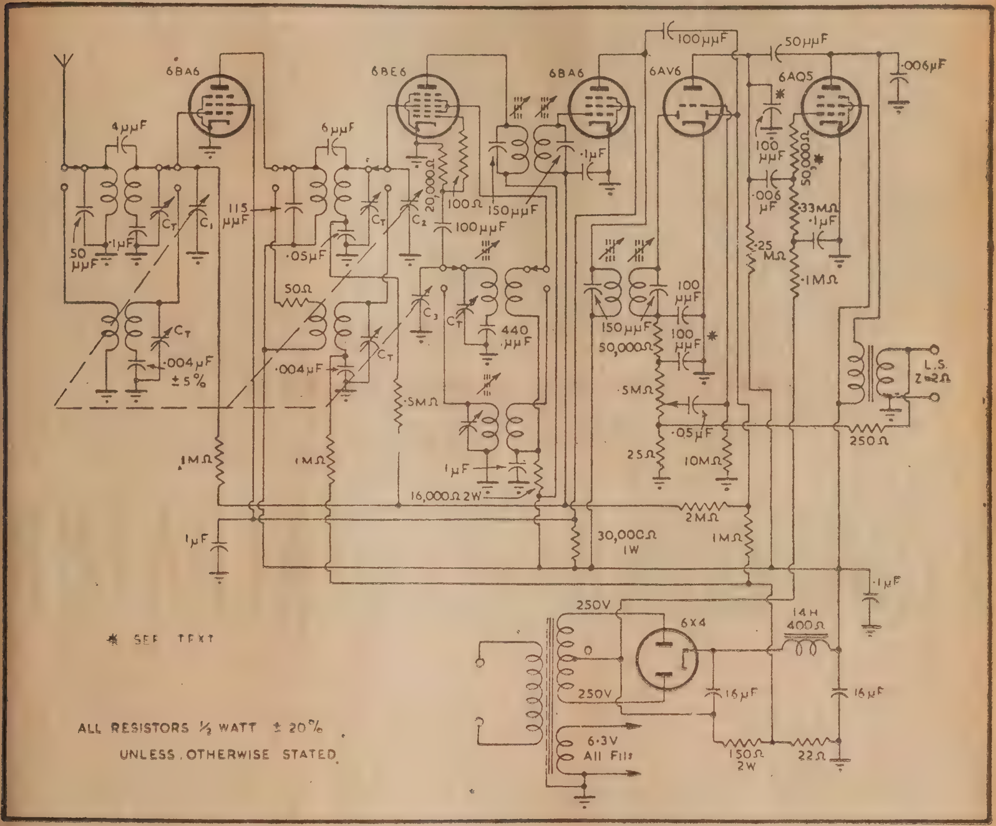
6BA6
4μμF
50 μμF
·1μF
C_T
C1
CT
·004μF ±5%
6BE6
6μμF
115 μμF
·05μF
50Ω
·004μF
C2
20,000Ω
100Ω
150μμF
100μμF
C3
440 μμF
·5MΩ
1μF
16,000Ω 2W
1MΩ
1MΩ
1μF
6BA6
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6AV6
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6AQ5
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·1MΩ
100 μμF
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100 μμF
·5MΩ
·05μF
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10MΩ
2MΩ
30,000Ω 1W
1MΩ
L.S. Z=2Ω
250Ω
·1μF
250V
0
250V
6X4
14H 400Ω
16μF
16μF
6·3V All Fils
150Ω 2W
22Ω
* SEE TEXT
ALL RESISTORS ½ WATT ± 20% UNLESS OTHERWISE STATED

The latest issue of "Radiotronics"—number 142—carries complete design data for a six valve receiver using miniature valves throughout Though assuming the use of dual-wave switching, it could be built up around miniature coils and I.F. transformers to make a compact high performance broadcast receiver.

TO keep to a minimum the number of parts required, a system of ack bias is operated in conjunction vith the AVC, allowing all cathodes o be earthed.

Special interest centres around the onverter stage, which uses a 6BE6, aving no separate oscillator anode. To avoid the necessity for tapped oils, the screen is made to serve dual purpose, and is fed through he "tickler" winding of more or less onventional oscillator coils. Separate eed is provided for this screen to nsure freedom from flutter on the hort-wave band.

A point of special interest is that he designers have suggested harmonic operation of the oscillator on hort-waves. In other words, the scillator of the 6BE6 is operated at half the normal frequency, and the mixing process utilises the second harmonic. It is claimed that this method largely avoids "pulling" effects and also minimises frequency flutter due to interaction with the audio channel.

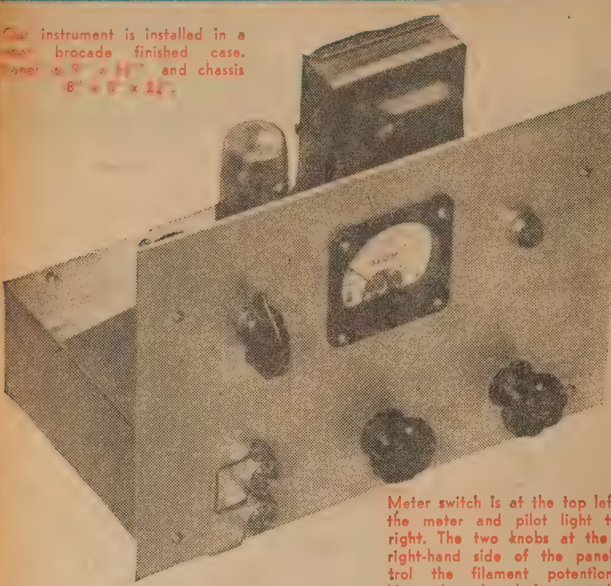
To preserve the same conversion conductance, the oscillator grid current on the short waves is deliberately increased above normal. Measured figures show a grid current varying between 500 and 760 microamps, as compared with approximately 220 microamps for the broadcast band.

The original design also provides for the oscillator harmonic to be on the low side of the signal frequency on the short-wave band, so that the padder capacitances are included in the signal tuned circuits. If the receiver was to be built up, using standard coils and with the oscillator, as normal, on the high side, a single padder condenser would be installed in the oscillator circuit only.

The gain on the broadcast band was deemed to be excessive, and the RF transformer primary was accordingly loaded to reduce the gain slightly. The series resistor in the corresponding short-wave winding serves to even out the gain across the band, and ensure stability at the high-frequency end.

In the audio end, negative feedback has been provided from the voice coil winding to the volume control circuit. Also a single condenser between the two audio plates provides feedback at high frequencies, and gives a general treble cut effect.

For the benefit of designers, exhaustive tests have been run on the prototype receiver ,and these are published in Radiotronics, together with curves &c.



The instrument is installed in a [illegible] brocade finished case. [illegible] and chassis 8" x 5" x 2½".

Meter switch is at the top left with the meter and pilot light to the right. The two knobs at the lower right-hand side of the panel control the filament potentiometers. Note that the shafts must be insulated.

A DIODE NOISE GENERATOR

Have you ever wished for a really quiet receiver? This article describes a simple instrument which enables the constructor to adjust his receiver for best performance without guesswork. It generates a steady noise signal which can be matched against the noise generated by the receiver itself. Improvements made by adjustment can be read off from a meter scale.

by Maurice Findlay

AS receivers become more sensitive, so does the problem of reducing noise become more acute, both external noise and that generated by the receiver itself. With modern circuitry, there is no longer any difficulty in providing sufficient gain, but the matter of making a high gain receiver with low noise level is not so easy.

Further, when adjusting a receiver in an effort to improve its performance, it is often very difficult, and sometimes impossible, to determine whether the receiver has actually been improved or worsened by individual minor adjustments. Yet the sum total of several minor adjustments may itself be very significant.

SIGNAL GENERATOR

It is possible to compare receiver performances with the aid of a signal generator and output meter, but this method has several disadvantages, which make it very involved. Furthermore, if accurate results are to be obtained, the measurements must be taken under laboratory conditions.

The chief difficulties are connected with imperfections in signal generators, which show up when taking noise measurements, even though the instruments may be perfectly satisfactory for other purposes. There also arises a necessity for having complete data on the bandwidth characteristic of the receiver under test.

Most of the measurement problems of receiver noise level can be overcome by employing a generator of noise, the output of which is known and can be controlled.

In this case, there is no need to know the bandwidth, as is necessary when using a CW generator, since the bandwidth of the receiver with respect to the noise generated by itself and that introduced externally is the same. Also, since the noise is generated at a low level, there are fewer calibration and shielding difficulties.

The use of a noise generator greatly simplifies the means of expressing the figure of merit of the receiver with regard to noise. The usual qualifying factors may be omitted and the performance of the receiver expressed, either as a simple ratio or in db. The receiver under test is compared with a perfect receiver. (In this case, by a perfect receiver we mean a receiver which generates no noise in itself.)

Before the concept of noise factor, was appreciated, the usual means of indicating receiver performance was simply to quote a figure of input signal required to give a standard output.

SENSITIVITY

For example, a certain receiver may require a signal of 20 microvolts to be fed into its aerial terminals to deliver the standard output of .05 watt. Under the older system, a receiver which required only a 10 microvolt signal, also modulated to the standard depth, to produce the .05 watt output, would be twice as sensitive.

This method of measuring receiver performance is only satisfactory at broadcast band frequencies and up to something in the order of 20 mcs., where the atmospheric noise level is likely to be the most significant factor limiting weak signal reception.

At higher frequencies, the atmospheric noise level may be quite low and weak, signal reception is then likely to be limited by the noise generated in the input stages of the receiver itself. It then becomes very necessary to consider this noise.

ELECTRON NOISE

It is not often realised that al matter generates noise, due to th random motion of electrons. If, fo instance, we are able to observe th motions of electrons in a conductor we find that at one instant there i a deficiency at one end and a surplu at the other. An instant later, th minute charge may be differently distributed.

This random motion of electrons i affected by both the temperature an the resistance of the conductor and therefore, the noise voltage appearing at the terminals of the conducto can be related to both the temperature and resistance. It increases wit both.

Even if it were possible to buil a receiver which did not generat noise, it would not be possible to build a noiseless receiving system, because even the aerial itself is a generator of noise.

Further, it has been proved that the noise voltage developed across the terminals of an aerial is the same as the noise voltage built up across the terminals of a resistor having the same value as the radiation resistance of the aerial, provided the temperatures are the same.

Thus, the noise generated by a half wave dipole aerial, which has a radiation resistance of 73 ohms, is the same as that generated by a 73 ohm resistor at the same temperature.

This noise generated by the aerial is quite distinct from radiated noise and would still be present even if the aerial were completely screened.

SIMILATES AERIAL

Therefore, for the purposes of measuring receiver performance, it is possible to replace the aerial with a non-inductive resistor having the same value as its radiation resistance. The resistor will then generate the same noise voltage as an aerial which is erected at some mythical noiseless location.

If a generator of noise, the output of which is known, is connected across the resistor, it is quite a simple matter to determine the noise factor of the receiver.

For example, if the noise generator is turned on and its output adjusted so that the noise power output of the receiver is doubled. The noise power output of the generator is then equal to the noise generated by the resistor, plus the noise generated by the input circuits of the receiver.

The smaller the amount of power required to double the output of the receiver, the lower is its internal noise level and the better its noise factor.

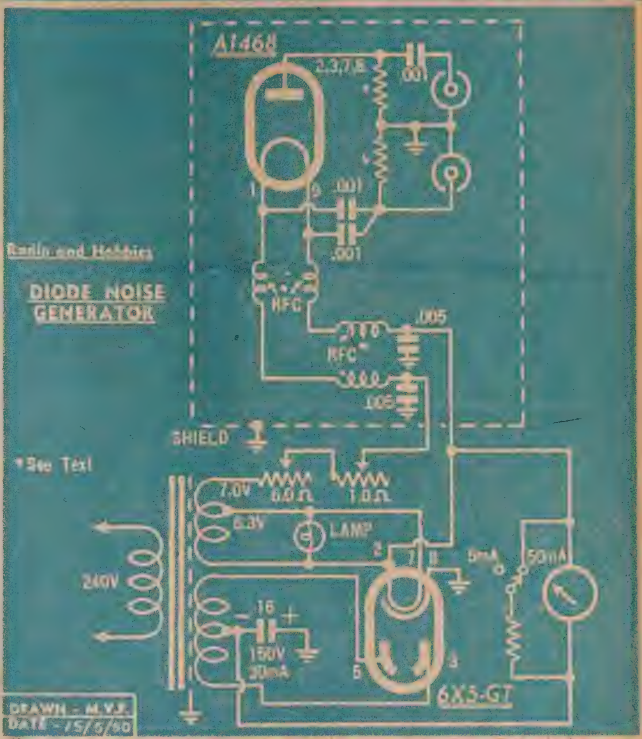
We previously mentioned that the noise voltage developed across a resistor depends on both its resistance and the temperature. The absolute value of the noise voltage so developed can be calculated from physical formulae. Therefore, a resistor of known value, the temperature of which can be controlled and measured, may be used as a generator of noise.

LAMP AS GENERATOR

An ordinary filament-type lamp can be used as a generator of noise for test purposes, but it requires laboratory instruments to make accurate measurements of its temperature and its resistance at various temperatures.

Another source of noise is the temperature-limited diode. This is much more interesting from the point of view of the home constructor, since all the measurements necessary to calculate the amplitude of the signal can be done with ordinary milliamp and ohm meters.

THE NOISE GENERATOR CIRCUIT



The circuit is very simple, but note that the positive terminal of the high-tension supply is earthed. The 16 mfd. electrolytic is the only filter component required.

The diode noise generator simply consists of a diode valve, the filament temperature of which is reduced so that the filament is saturated.

When a filament is saturated, an increase in plate voltage has no effect on the plate current. Electrons leave the filament in a random and jerky manner under these conditions, and a noise voltage is developed between filament and plate.

The noise voltage developed is proportional to the number of electrons moving from cathode to plate, and therefore is proportional to the plate current. This fact makes practical comparative measurements very easy.

It is important that the filament be fully saturated, otherwise a space charge will form around it, and the space charge will act as a reservoir and a smoothing medium for the current of electrons moving from filament to plate. That is, if the filament is not saturated, the noise voltage will be lower than the figure calculated.

In practice, it is a simple matter to check for saturation. Increase the plate voltage slightly, and if the plate current does not change, the filament is saturated. Valves with pure tungsten filaments are best suited for noise generator work, since a pure tungsten filament saturates easily.

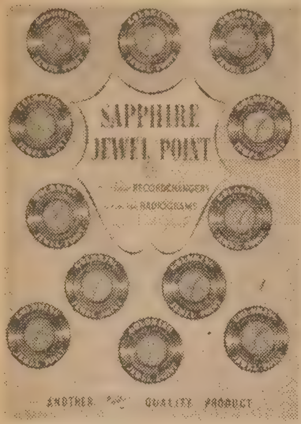
The noise voltage generated by a temperature-limited diode is evenly distributed throughout the spectrum. However, at very high frequencies it is attenuated by valve and circuit capacities and valve and lead inductance. Therefore, above a certain frequency, which incidentally is difficult to determine by the means open to the average experimenter, the noise output of the generator will be less than the calculated figure.

COMPARATIVE TESTS

This prevents us from taking absolute figures of noise factor at VHF, but it in no way detracts from the value of the instrument for making comparative measurements, provided the output is sufficient to operate the indicating devices to the required degree.

Our own interest in the subjects of noise factor and its measurement by means of the temperature limited diode was stimulated by the release in Australia of a special valve for the purpose. The type number is A1468.

NEW ADDITIONS TO THE 'GOLDRING' RANGE—1950



SAPPHIRE S/5. This newly-developed **Sapphire Jewel Point Needle,** is the latest addition to the range of "Goldring" Sapphire Needles which enjoy a high reputation for uniformity. It is the result of many experiments conducted with the main object of finding the ideal needle of a resillient and shock absorbing type for use with **modern record changers.**

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Gramophone Needles 100
Gramophone Needles 100

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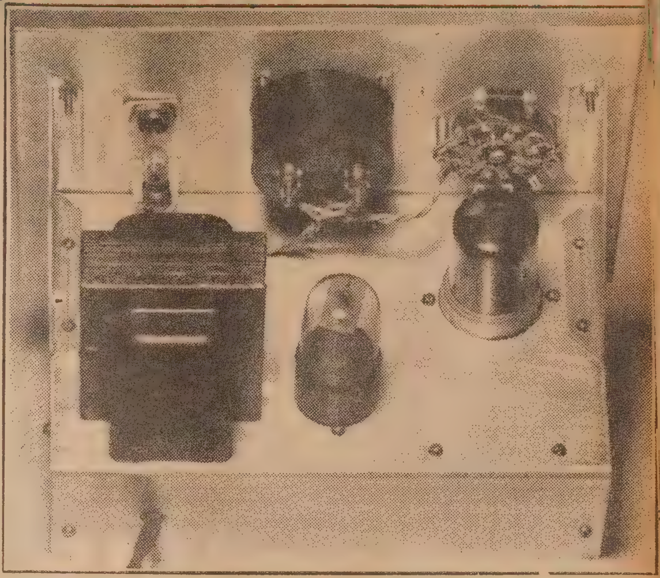
REAR AND UNDERNEATH VIEWS



Assembly should not take very long since there are few components. Both terminals of dial lamp must be insulated from the chassis.

The A1468 has a pure tungsten filament and the saturating plate current can be varied over a wide range by adjustment of the filament temperature. Special construction ensures that the internal capacitance and connecting lead inductance is low so that the valve will deliver noise output at very high frequencies The plate of the A1468 is designed to dissipate a fair amount of heat so that noise at reasonably high power can be developed when required.

Although the A1468 is probably the most suitable valve for noise generator work there are other valves which can be made to operate quite well. The main disadvantage of less specialised types is likely to be a falling off in noise output at higher frequencies.

ALTERNATIVE TYPES

Type 201A, well known to experimenters of some years back, has a pure tungsten filament and can be used for noise generator work. The filament is rated at 5 volts. The 801A also has a pure tungsten filament and has successfully been used in noise generators which were not required to operate at very high frequencies. The filament is rated at 7.5 volts. Both valves are triodes and it is necessary to connect the plate and grid together.

The British type CV172 is another diode designed especially for noise generator work. It appears to be very similar to the A1468 used in our experimental instrument.

There are possibly other types which may be used. The main point to remember is that ordinary oxide coated filaments are quite unsatisfactory under temperature limited conditions. Thoriated tungsten filaments can be used in an emergency but a pure tungsten filament is desirable.

Valve structure and lead length determine the upper frequency limit of the generator and while one of the less specialised types may be perfectly satisfactory at, say, 30 mcs., the output may not be sufficient to allow even comparative measurements to be taken at 100 mcs. or thereabouts.

CONSTRUCTION

We desired a neat and portable instrument for conducting noise factor tests in our own laboratory and accordingly our instrument was designed to fit a standard small instrument case. All controls requiring adjustment are mounted on the front panel together with the output terminals and indicating meter.

The generator diode is mounted on the chassis behind the panel and as close as possible to the output terminals in the interests of short connecting leads. All power supply components are mounted on the opposite end of the chassis so that it is possible to shield the generator circuit and prevent the entry of unwanted signals to the receiver input terminals. Our completed instrument includes a shield running across the chassis and between the A1468 and the 6X5-GT enclosing the diode circuit filament chokes &c. It may even be desirable in certain cases to provide a shield for the A1468.

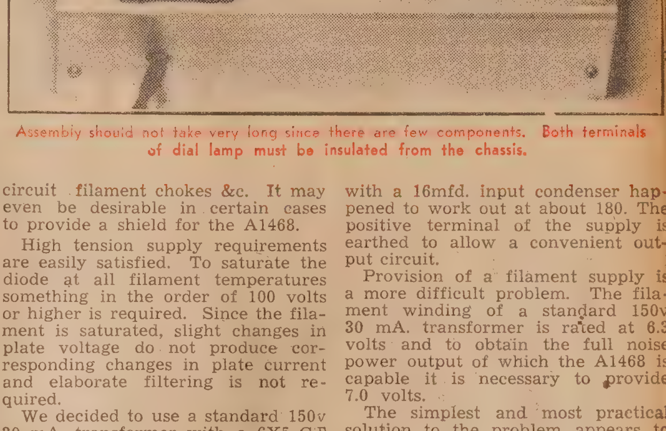
High tension supply requirements are easily satisfied. To saturate the diode at all filament temperatures something in the order of 100 volts or higher is required. Since the filament is saturated, slight changes in plate voltage do not produce corresponding changes in plate current and elaborate filtering is not required.

We decided to use a standard 150v 30 mA. transformer with a 6X5-GT rectifier and the high-tension voltage with a 16mfd. input condenser happened to work out at about 180. The positive terminal of the supply is earthed to allow a convenient output circuit.

Provision of a filament supply is a more difficult problem. The filament winding of a standard 150v 30 mA. transformer is rated at 6.3 volts and to obtain the full noise power output of which the A1468 is capable it is necessary to provide 7.0 volts.

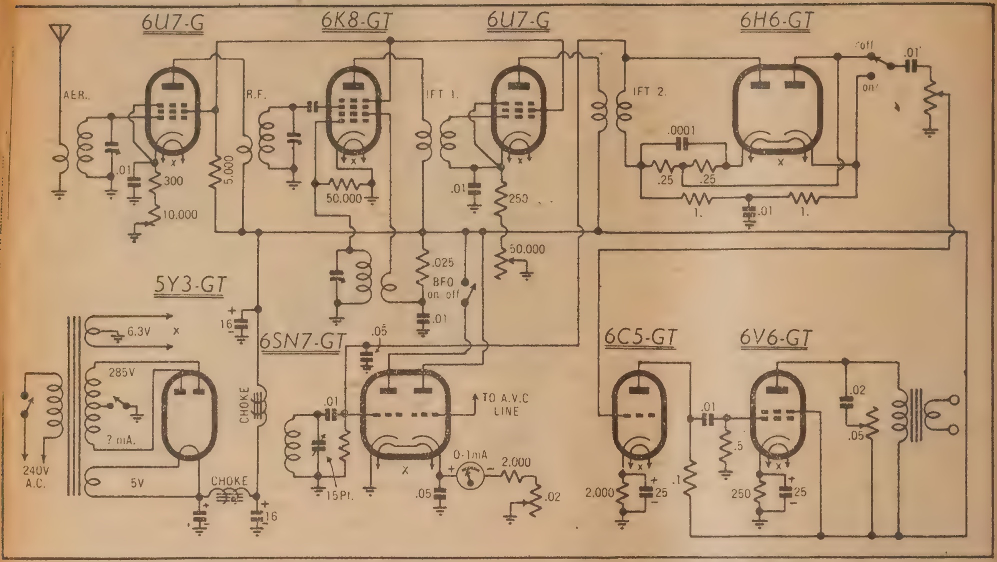
The simplest and most practical solution to the problem appears to

(Continued on Page 99)



Underneath view of diode generator with the shield around A1468 circuit removed. More elaborate filament chokes have been installed since the photograph was taken. Details are given in the text.

FOR THE JUNIOR EXPERIMENTER



Here is a circut submitted for comment by an aspiring amateur. We picked it to pieces rather unmercifully.

The circuits for comment this month come from a New Zealand reader, who is aspiring some day to possess an amateur licence. Would you vote his circuits as good, bad or indifferent? Examine them carefully first and then read our own comments and criticism.

THE first circuit is for a communications receiver; but it would need quite a few amendments before the signals could come rolling in.

As a general criticism, he has suggested the use of a commercial coil kit and makes no provision for bandspread. This is a fundamental error, as will be appreciated by anyone who has attempted serious work in the amateur bands.

On the surface, it is nice to be able to tune to any frequency in the short-wave spectrum, and it is undoubtedly what the avid short-wave fan wants to do. But an amateur soon develops a complete disregard for all other signals and concentrates on the narrow little bands allotted to his own use. Sooner or later he admits that general coverage is far less important to him than plenty of bandspread in the right place.

BANDSPREAD

Our advice to this New Zealand reader, therefore, is to accept this from the start and plan his amateur receiver to have spread on the "ham" bands at all costs. What he may be able to provide after that in the way of general coverage, and what coils he uses, are second-order decisions.

Coming to the circuit itself, we note there is no provision for AVC, although the "S"-meter circuit assumes its use. AVC should be included for phone work, even if it is a simplified system.

The earth return for the secondary of the aerial coil and for IFT1 should be broken and bypassed to earth with condensers—.05mfd or thereabouts. The aerial coil return would then run through a 0.1meg to the IFT1 return, and thence through a 1.0meg resistor to the junction of the IFT2 secondary and its load circuit.

USE A DIODE-PENTODE

Better still, the 6U7-G IF amplifier might be replaced with a diode-pentode like the 6G8-G, EBF2, or 6AR7-GT, and the diodes used to provide a separate system of delayed AVC. This is normal practice in R&H circuits, and readers can refer to almost any one of them for more complete details.

For CW work, it would be desirable to render the AVC inoperative, the simplest method being to earth the junction of the AVC line and the secondary of the IFT1.

When the AVC is earthed, the gain of the set, in the tuner portion, must be reduced on strong signals by means of a manual control. The circuit shows separate cathode gain controls for the RF and IF amplifiers; but, for simplicity, these could be resolved into a single, 10,000-ohm potentiometer in the cathode return circuit for both valves. Retain the present separate cathode resistors and bypass condensers in the interests of stability.

Coming to the screen circuits, all three screens for the first three valves are fed through a common resistor and are not bypassed. A 0.1mfd bypass might be satisfactory; but, if the set is at all "touchy," a larger condenser would be necessary for stable operation. In fact, a separate feed and bypass for at least one of the stages would be an excellent precaution against any trouble along this line.

As it is, the screen resistor has too low a value. Total screen current for the two 6U7's and the 6K8 is approximately 10 milliamps. Since the high-tension voltage is likely to be about 250 and the required screen voltage 100, the voltage drop across the feed resistor must be 150-odd volts. By Ohm's law the dropping resistor will be:

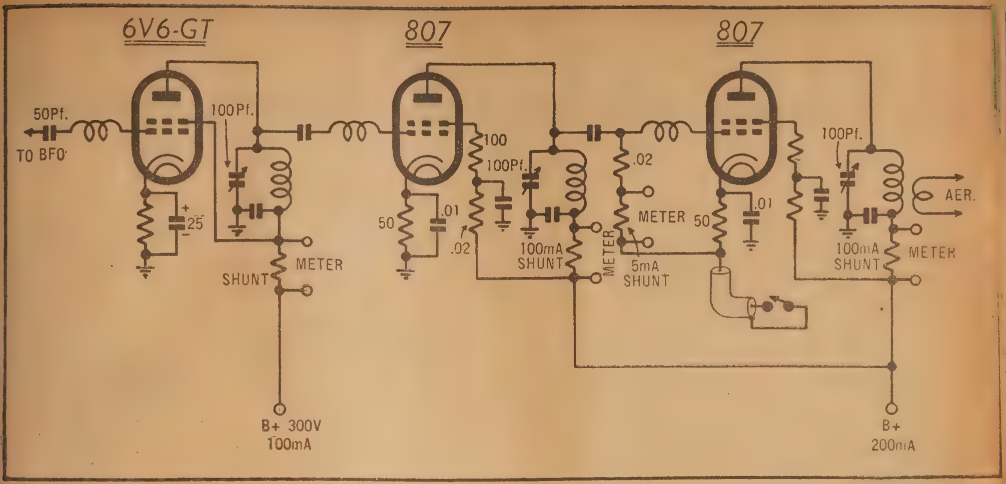
R = 150 x 1000 divided by 10
= 15,000 ohms

THE 6K8 CIRCUIT

If the 6K8 screen were to be fed separately, the dropping resistor for just the two 6U7 screens would then be:

R = 150 x 1000 divided by 4
= 37,500 ohms (40,000 approx.)

Coming to the 6K8, quite a few things are wrong. The grid should connect straight to the top of the coil and not through a condenser. The present arrangement leaves the grid without a d-c return to earth.



Companion circuit to the receiver opposite is this 3-stage transmitter. But are three stages necessary and if so, is the circuit otherwise in order?

The condenser is apparently the one intended for the oscillator grid circuit and omitted from it. To put the oscillator right, it would be necessary to insert a 50pf condenser in series with the lead from the oscillator grid and grid resistor to the top of the oscillator coil.

Next point is that the 6K8 has no provision for bias and, in conformity with the other stages, it would normally be connected in the cathode circuit. Install a resistor of about 300 ohms and a 0.1mfd bypass between cathode and earth, remembering that the oscillator grid resistor must still connect direct from oscillator grid to cathode.

The oscillator plate current of the 6K8 is quoted as 3.8 milliamps at 100 volts. Allowing for a 150-volt drop from the high-tension line, the dropping resistor works out at:

R = 150 x 1000 divided by 3.8
= 40,000 (approx.) ohms

Obviously, the 25,000 ohms shown in the circuit is too low, while the .01mfd bypass is also inadequate on its own for a short-wave set.

RATINGS

For the 6K8, manufacturers recommend that the oscillator plate and the screen should be fed through a common 15,000-ohm 3-watt resistor, with a common 0.1mfd bypass. An additional 8mfd electrolytic condenser in parallel with this bypass is a precaution against motorboating or tuning swing due to variations in the power-supply voltage.

A final point is that the circuit does not show a padder in the oscillator section—this being a very necessary aid to tuning if a gang condenser is used.

The IF stage shows an obvious error, in that the grid circuit is returned direct to cathode. Not only would this invalidate the normal 300-ohm cathode circuit bias, but it would render ineffective the potentiometer in the cathode circuit. Varying the potentiometer setting would not affect the grid-cathode bias, but only the effective voltage across the valve.

To put the circuit into order, the grid return would have to be made, as already outlined, to the AVC line and duly bypassed to earth. Then the cathode would return, through its 300-ohm limiting resistor, to the gain-control, in common with the RF stage.

The diode detector and noise-limiter is standard, apart from the omission of an earth-connection for the first cathode. The rest of the audio circuit is also in order, the only query being the rather low value of the cathode resistor for the 6C5. While 2000 ohms would work, the optimum value for a 6C5 with the 0.1meg plate-load shown is nearer 5000 ohms.

"S" METER CIRCUIT

The "S" meter valve should be okay, but two changes must be made to the beat oscillator. Substitute a .0001mfd unit for the .01mfd grid condenser, while a very small capacitance should be connected in series with the lead to the detector. In fact, it is normally sufficient to wind the lead from the BFO two or three times around the "hot" diode lead.

For the power supply, the only query is in regard to the current rating of the transformer and chokes.

In round figures, one can count on 10 milliamps each for the first three valves and 50-odd for the 6V6, making 80 milliamps in all—the current drain of the remaining valves, being of little consequence. In any case, the difference would be more than accounted for by the fact that the 6U7's would frequently not be required to operate at full gain and current.

Should the power transformer tend to heat up after long periods of operation, a few milliamps could be saved, without ill-effect, by increasing the bias resistor for the 6V6 to 300 or even 350 ohms.

Coming to the transmitter circuit the first obvious point is that three stages may not be required. Much would depend on the output from the VF0; but if it were sufficient to load up a 6V6, then the 6V6, in turn, would drive the 807 output stage. Thus there is a good chance that two stages only would be required.

To use more stages than necessary only makes things very difficult when the transmitter is operating "straight through" and all circuits are tuned to the one frequency.

In general, it is seldom necessary to connect suppressor chokes in the grid circuits of a 6V6 valve, but the grid resistor omitted from the circuit is a very important component.

For full protection, the cathode circuit resistor would need to be at least 200 ohms, while a dropping resistor and bypass could well be included in the screen circuit. Much depends on the drive available, but we would suggest about 20,000 ohms, with a .001mfd bypass and fed from the B-plus side of the metering circuit.

METERING

The metering circuit should be arranged to read up 50 or 100 milliamps, the average plate current for a 6V6 running around 30 milliamps in this class of service.

Coming to the 807, the only obvious error is the omission, once again, of the grid return resistor. The inclusion of a small suppressor choke, in this case, is a wise precaution. The final stage is in order, and up to 600 volts could be applied to the plate circuit before you would have to worry much about how the 807 is liking it.

About 600 volts and up to the permitted maximum of 750 volts, things have to be just right if the 807 is not to be "slain in its tracks."

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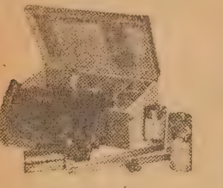

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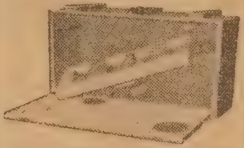

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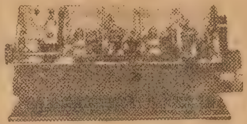

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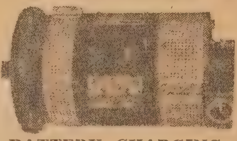

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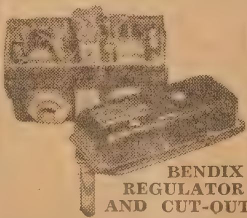

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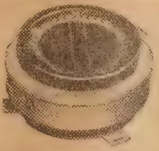

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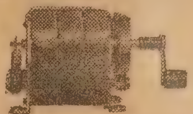

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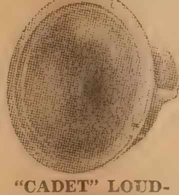

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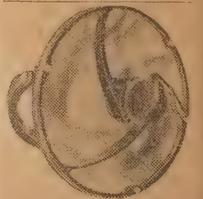

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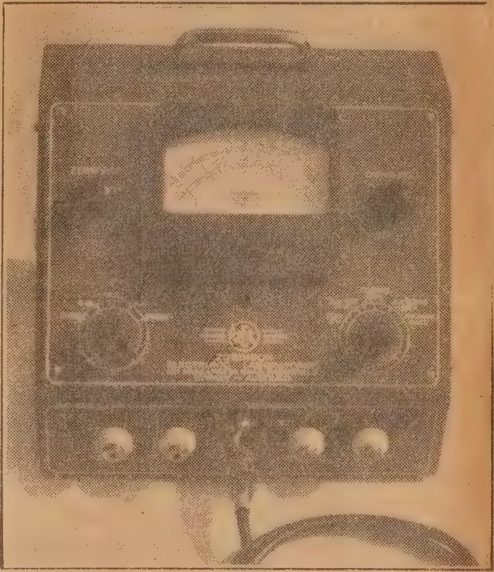
TRADE REVIEWS AND RELEASES

A NEW ELECTRONIC SERVICE MULTIMETER

Designed for general laboratory work and radio servicing, a new electronic multimeter has been released by Robinson Electronic Laboratories. It provides a wide range of voltage and resistance measurements and comes complete with an R.F. probe.



THE general circuit arrangement is said to be along lines similar to the R. & H. Vacuum Tube Voltmeter recently described, in that it is built around a 6SN7-GT metering tube, with a miniature diode in the RF probe.

Special attention has been paid to simplicity of control and calibrating resistors for the individual ranges are wired to the range switch and adjusted at the factory for each instrument. To select any particular range, it is merely necessary to plug the test leads into the appropriate sockets and rotate the function switches as required.

Zero and full-scale adjustments are provided for the ohms ranges.

The meter is a four-inch square type, mounted on a sloping panel and calibrated in two colors. The instrument is designed normally to operate from the 240-volt a-c power mains, but an external vibrator supply can be provided as an extra item for battery operation.

As a voltmeter, the instrument has an input impedance of approximately ten megohms on all ranges, a-c, d-c and negative d-c. There are six d-c voltage ranges covering 0-3-1800 volts. On a-c, the ranges run from 0-3-600, and, by using the probe at UHF, are substantially independent of frequency.

There are five sets of ohms readings allowing resistance values to be read off between 0.2 ohm and 1000 megohms.

Inquiries can be made through trade houses or direct to the manufacturers — Robinson Electronic Laboratories, 107 Parramatta Road, Haberfield, NSW.

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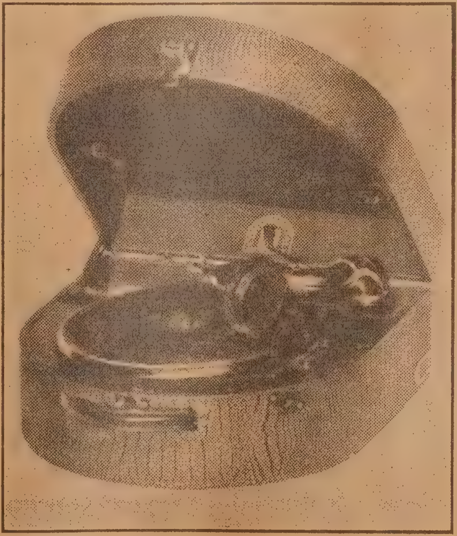

BY means of a switch under the turntable, the motor can be set to run from either a-c or d-c power mains and voltages between 100 and 240. Tests have shown that it will also run from 32-volt d-c mains, as for home lighting plants.

If no power is available, a winding handle can be inserted through a hole in the front of the case and the motor becomes spring driven. The auto stop is both electrical and mechanical in its action.

The output from the acoustic head is high, tonal quality being consistent with this type of instrument. Retail price in Sydney is £21/15/-, and the gramophone is available through music stores or from Fred A. Falk & Co., 28 King Street, Rockdale, NSW.

Goodman's Speakers

BRITISH Merchandising Pty., Ltd., of 183 Pitt Street, Sydney, Australian factory distributors for Goodmans Industries, announce the release of two new high fidelity loud speakers. These are the Axiom 150 and the Audiom 60, and they supersede the Axiom 12 and T2/12, respectively.

These new speakers are fitted with a new magnet, which has a flux density of 14,000 gauss and provide a total flux of 158,000 maxwells on a 1¾in pole piece. The two speakers are identical, except for the cone assemblies.

The Axiom 150 has a twin curvelinear cone with a frequency range of from 40-15,000 cps., while the Audiom 60 has a single curvelinear cone with a range of from 40-10,000 cps.

Both speakers have a fundamental resonance of 55 cycles, an impedance of 15 ohms at 400 cycles and a peak power handling capacity of 15 watts. The prices are £14/18/- for the Axiom 150 and £11/19/6 for the Audiom 60.

British Merchandising advise that, in future, all Goodmans twin cone high fidelity speakers will be known under the general name of "Axiom" and all single cone high fidelity speakers under the name of "Audiom."

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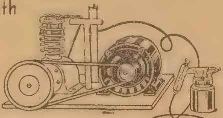

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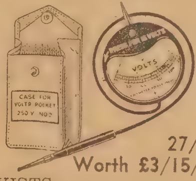
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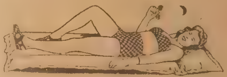

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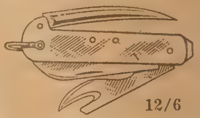

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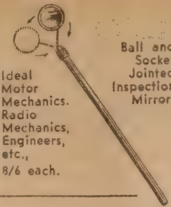

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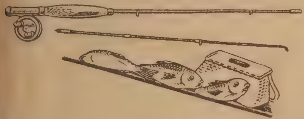

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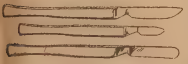

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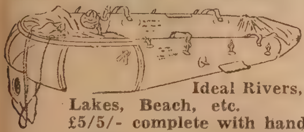

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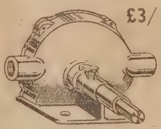

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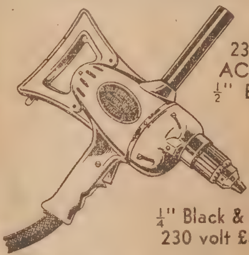

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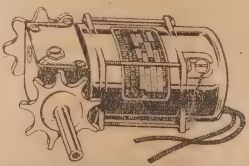

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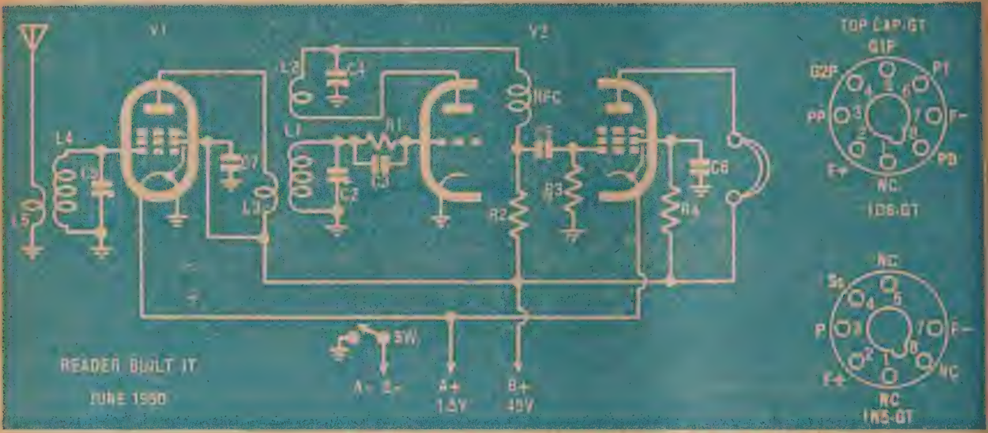
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters. •

A HIGH GAIN SET FOR EARPHONE LISTENING



The circuit is quite simple. A small [illegible]

Although 1D8-GT valves are scarce in the shops, to judge by our mail, a fair number of them must still be in the hands of experimenters. Using this valve a New Zealand reader has built up a 2-valve set having virtually three stages.

THE circuit comes from Mr. R. R. Clarke of 54 Cooper Street, Karori, Wellington W3, New Zealand. He points out that it is not an original effort having been taken originally from a 1946 issue of "Radio Electronics." However, its performance over two years has been so good that he feels other readers may care to try it out.

Says Mr. Clarke, "Battery life is long, over 18 months use being possible. The range of the receiver is remarkable on broadcast. At night all N.Z. stations are heard at excellent volume.

"Australian stations can be heard all the year round and in season the USA broadcast stations can be heard clearly. On one occasion India was logged. Although a TRF circuit, tuning is sharpened by a slide tuning coil in the aerial lead.

"The set is cheap to build and operate and is recommended to anyone who wants a small outfit that will drag them in.

"I am in a city location with an aerial 100 feet long wandering in three directions to get the length. Height is about 20 feet. The set will operate a 5 inch speaker which, when used, is plugged into the phone outlet.

"Plug in shortwave coils can be used but with the tremendous range and volume on broadcast and the wealth of entertainment available as a result, I have not bothered about shortwave listening."

THE CIRCUIT

Reviewing the circuit briefly, it uses a 1N5-GT as an R.F. amplifier, operating with zero bias and the full high tension voltage on plate and screen.

The triode section of the 1D8-GT is used as a conventional grid leak detector with condenser controlled reaction. Two coils would be needed, an aerial coil and an R.F. coil with reaction. The two should preferably be of the same brand to ensure correct tracking, while trimmers should be wired in parallel with C2 and C8 to peak the circuit.

Output from the detector feeds into the pentode grid of the 1D8-GT, which is shown with zero bias. The plate current has been limited by including a series resistor in the screen circuit. For best loudspeaker operation, R4 would be omitted with screen going straight to B plus. At the same time R3 should be returned to minus 4.5 volts on a C battery, the positive terminal being earthed.

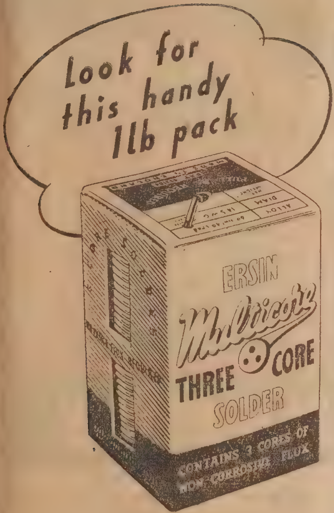
PARTS LIST—COIL DATA

C2, C8 0.00035 mfd. max. variable
C3 0.0001 mfd. fixed.
C4 0.0003 mfd. max. variable.
C5, C6, C7 0.1 mfd.
V1 1N5-GT.

V2 1D8-GT.
R1 2 megs.
R2 50,000 ohm.
R3 5 megs.
RF4 20,000 ohm.
RFC 2.5 mh. choke.

L1 105 turns 36 gauge en. close wound.
L2 30 turns same wire close wound ⅜" from top of L1
L3 40 turns same wire wound over bottom end of L1.
L4 105 turns 36 gauge en. close wound.
L5 20 turns same wire wound over bottom end of L4. 1¼ inch former.

This job is MUCH HARDER than it should be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4 AEGIS TUNING AND INSTRUMENT KNOBS all sizes and types including Vernier drive.

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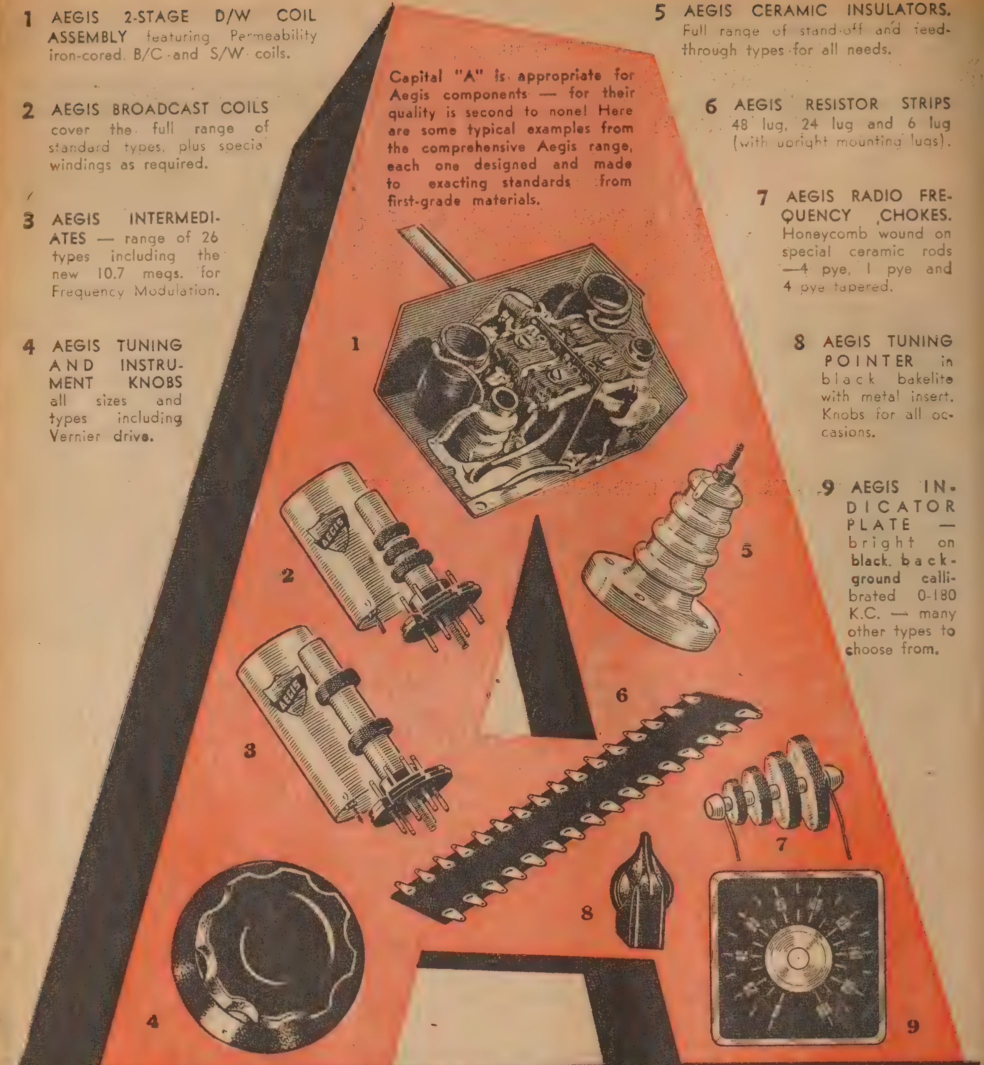
7 AEGIS RADIO FREQUENCY CHOKES. Honeycomb wound on special ceramic rods —4 pye, 1 pye and 4 pye tapered.

8 AEGIS TUNING POINTER in black bakelite with metal insert. Knobs for all occasions.

9 AEGIS INDICATOR PLATE — bright on black background calibrated 0-180 K.C. — many other types to choose from.


Capital "A" is appropriate for Aegis components — for their quality is second to none! Here are some typical examples from the comprehensive Aegis range, each one designed and made to exacting standards from first-grade materials.

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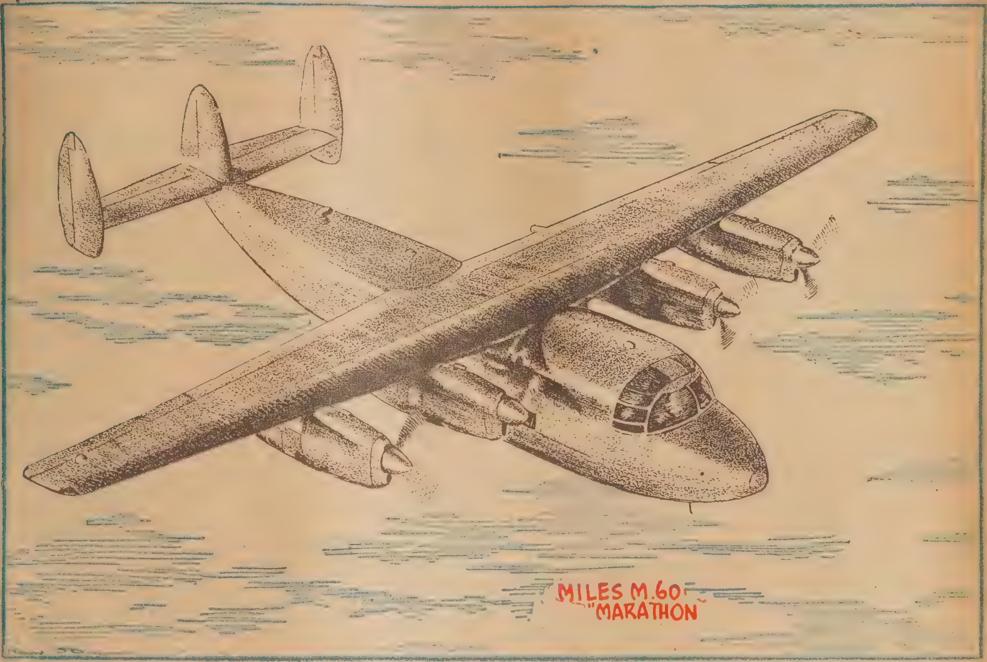
A NEW FEEDER-LINE TRANSPORT



Designed by the Miles Aircraft Co. of England for operation as a feeder aircraft over ranges of up to 800 miles, the M.60 "Marathon" first made its appearance four years ago.

RECENTLY a Marathon was flown to Australia, on a demonstration tour. Flying time from Blackbush (England) to Sydney was approximately 75 hours.

This four-engined cantilever high-wing monoplane is unique in its class as an 18-22 seat feeder-line airliner or freighter. It was originally designed to meet the specifications of Britain's Brabazon committee for a Type V. medium-range feeder aircraft.

EASY ACCESS

A feature of the design is that when the plane is on the tarmac, the cabin floor is only 30 inches from the ground, a valuable factor in simplifying the loading of heavier freight items, and eliminating the need for cumbersome passenger steps.

The fuselage of the Marathon is of all-metal monocoque structure consisting of 47 pressed channel-section frames of light alloy. Plywood covers the pressed-sheet alloy frames of the floor construction.

Originally the tail unit was of twin fins and rudders mounted as endplates to the tailplane, but a third fin and rudder has been added in the centre.

The landing gear, which is fully-retracting, is of the tricycle type. Each main unit retracts forward in an inner engine nacelle and is enclosed by twin doors. The retraction is pneumatically operated, and pneumatic brakes are fitted to the main-wheels.

The nose wheel is the same size as the main-wheels, and is interchangeable with them. It retracts forward into the nose and is enclosed by twin doors.

A rubber bumper skid with a metal sheath is fitted to the underside of the rear of the fuselage.

FOUR MOTORS

Power comes from four D. H. Gypsy Queen 71 six-cylinder inline motors of 250 horsepower each. For take-off, a total output of 1320 horsepower is available. Propellers are of the three-blade, constant-speed full-feathering type.

A crew of two is carried—pilo and co-pilot/navigator seated side-by-side. Dual controls are fitted, bu the second set of controls can b removed to allow the permanen installation of a navigator's table.

Baggage compartments are locate behind the cockpit and in the rea of the fuselage.

WEIGHT FIGURES

Weight of the passenger version empty, is 11,460lb, and of the freighter version 10,690lb. In each cas loaded weight is 16,500lb. Win loading, at loaded weight, is 33l to the square foot.

Maximum speed of the Maratho with Gipsy Queens is 230 miles a hour at 6300ft. Top cruising spee is 210 miles an hour, but economica cruising speed is 175 miles an hour

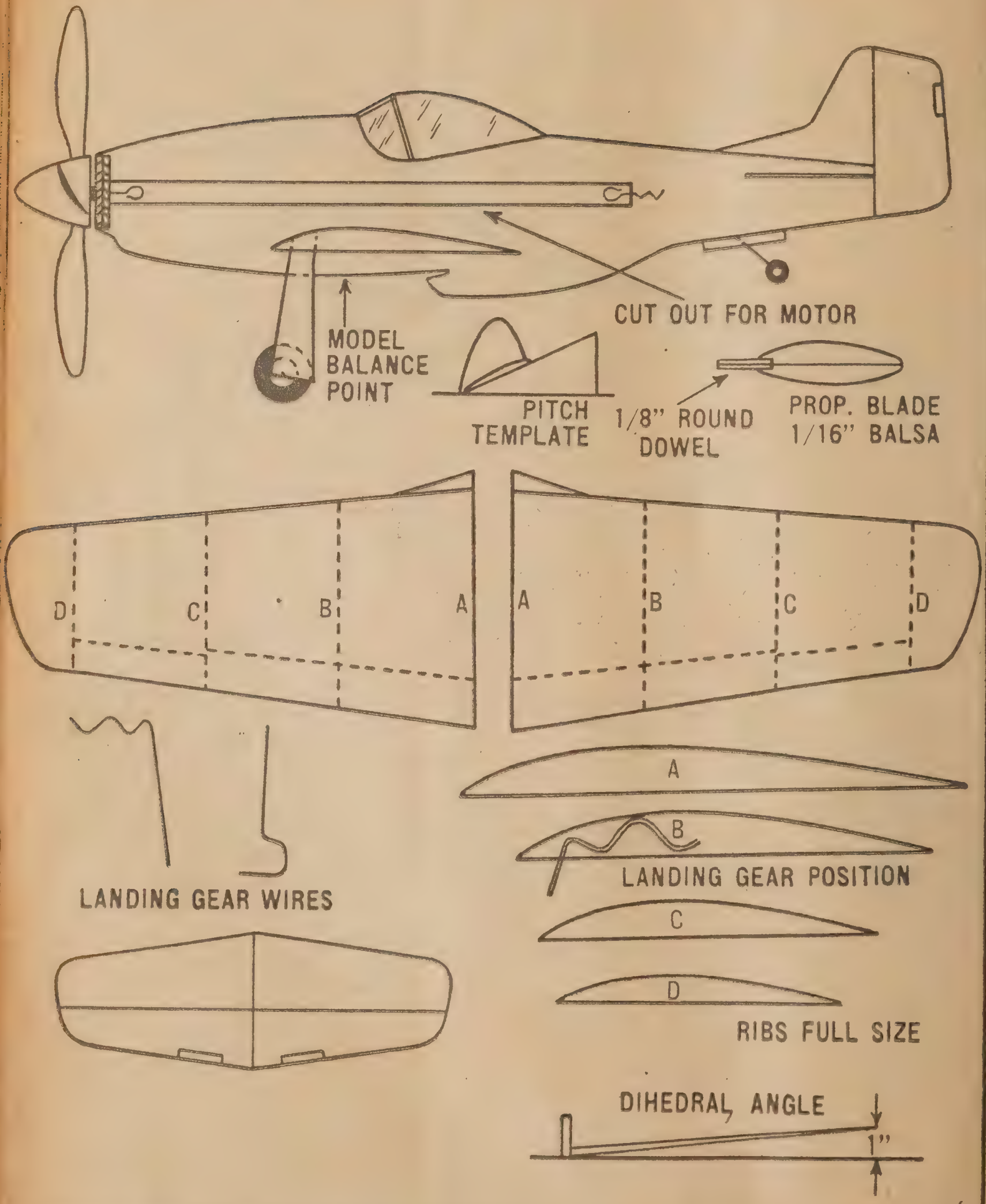
Main dimensions of the aircraf are: Wingspan 65ft 10in, length 52f 1in and height 13ft 9in.

Production of Marathons is proceeding steadily and output is thre a month.

Another version, powered by two Armstrong-Siddeley Mamba gas-turbine engines, is designated M.69. The prototype has been flying developmentally for some time.

PROFILE SCALE MUSTANG

P51-D


CUT OUT FOR MOTOR
MODEL BALANCE POINT
PITCH TEMPLATE
1/8" ROUND DOWEL
PROP. BLADE 1/16" BALSA
D
C
B
A
A
B
C
D
LANDING GEAR WIRES
A
B
LANDING GEAR POSITION
C
D
RIBS FULL SIZE
DIHEDRAL ANGLE
1"

MAKING A SCALE MODEL MUSTANG

We have never previously featured a full flying scale model plane in these pages due to the complex nature of such a model. But this month we are going half way. This machine is known as a profile scale model, that is, it resembles the machine it is modelled after from the side view in relation to fuselage, undercarriage and rudder, and from the top view it bears resemblance in wing and tailplane outlines.

IT is, in fact, a flying scale model profile style, of the famous Mustang single-seat fighter aircraft. By adapting the profile design, it is possible to secure a measure of likeness to the original plane, coupled with ease of construction and reasonably good flight characteristics.

Let's discuss the full-size aircraft for a moment, so as to become more familiar with the plane which we are going to model.

RECORD PRODUCTION

The Mustang single-seat fighter, which played a very important role in the past great conflict, was designed, built, flown and accepted in a matter of just one hundred days — surely something of a record.

It started off as a reconnaissance fighter for Britain, and was then developed into the A36 attack version. It was proving itself as a very capable machine in action, and North American Aviation Co. began a programme of improvement which led up to the P-51D version, which was probably the most outstanding single-seater in use at the end of the war.

Some of the changes made during its life include the substitution of the Packard-built Rolls-Royce in place of its original Allison engine, changing position and shape of the air-intake scoops and the addition of a dorsal fin and the newer bubble-type canopy. It is still one of the fastest of the single-seat piston-engined fighters of today. No doubt many of you have seen Mustangs flashing through Australian skies or doing aerobatics at some RAAF display, as the RAAF is currently using them while changing over to the newer jet machines.

As always, the first thing to do before commencing the construction of a plane is to draw up a work plan. To make matters easy, we have made our drawings half the original size. All you have to do is double each measurement, and you have your full-size plan, which is built to the scale of 3-8in to the foot in relation to the full-size plane.

THE FUSELAGE

Firstly, let us make the fuselage. To do this we trace the fuselage design on to a piece of medium balsa panel which measures 2½in x 10¼in. The easy way to do this is to use carbon paper between your plan and the balsa. This will leave the plan intact for future reference.

Working to the outlines obtained in this fashion, cut out your fuselage, using a sharp knife or razor blade. Be careful to get the slot for the stabiliser accurately, as it must line up properly with the wing position. Otherwise you wil run into difficulties when adjusting for flying trim.

Be careful, also, to get the nose square with the cutout for the motor, otherwise the thrust line will be out. This can lead to difficulty in flight adjustments at a later stage.

Now cut out two discs of 7-8in diameter, and cement one in place on the front of the fuselage as indicated. From this disc, cut out a square in the centre, 3-8in x 3-8in, to allow the propeller hook to pass through. The 3-8in x 3-8in which is removed from this disc is then cemented to the other one, and set aside to dry.

It is a good plan, also, to cement a small tin or copper washer on the opposite side to this square to act as a thrust-bearing for the propeller.

Having gone this far with your fuselage construction, it is now time to reach for that sandpaper (thought I'd forgotten, did you?), to nicely round all corners and polish up the flat surfaces. That old sandpaper really adds the finishing touch, doesn't it?

TAIL AND RUDDER

Now trace the tailplane and rudder on to a good straight piece of 1-32in panel and cut out. Smooth up the edges with fine sandpaper and cement in place on the fuselage. Be careful to get the rudder vertical with the fuselage and the tailplane square with both of them. Cement liberally, and try to form a cement fillet between the tailplane and fuselage.

The bubble-canopy is best made from thin sheet celluloid, cutting out two pieces to the pattern and cementing in place along each side of the fuselage. When these joints are dry, cement along the top and you have your completed fuselage, which can now be put aside until you are ready to assemble the complete plane.

by Jack Finneran

Before putting aside the fuselage, we had best add the tail wheel and rear rubber hook. The drawing, I feel, explains the method rather better than words.

The next, and perhaps the most difficult, task is the wing, which is fabricated from thin sheet coveri and heavier sheet ribs.

Cut out your two wing panels fro 1-32in balsa sheet and lightly san Mark on one side of each the rib pos tions and be careful to see that y get one right and one left-hand pan

The ribs are then cut out as p plan from 1-16in sheet balsa a cemented in position on the wi panels. Use small pins to hold the in place while they are drying, as v have to make sure that the she balsa curves down over them to g the cambered wing section.

WING MOUNTING

Now cement the leading edges place and when dry, round off th corners and polish each panel wi smooth sandpaper. That complet the wings, and we are now ready f final assembly.

Cement the wings in place on th fuselage, making sure you get th same dihedral angle in each half an also that you get each wing at th same incidence angle.

This is extremely importnt, as mis takes regarding these angles can b disastrous.

We can now make up our under carriage struts from 20 or 22 gaug steel wire. There again we have left and right-hand gear to conside

These should be cemented ver securely to the ribs indicated on th plans, and I would certainly sugges that two coats of cement be used t secure really good adhesion at thi shock point.

Odd the struts shown, which ar cut from 1-32in balsa panel b cementing at the rib and all the wa down the wire. Slip on the wheel and secure with a small piece of bals cemented on the end of the axles.

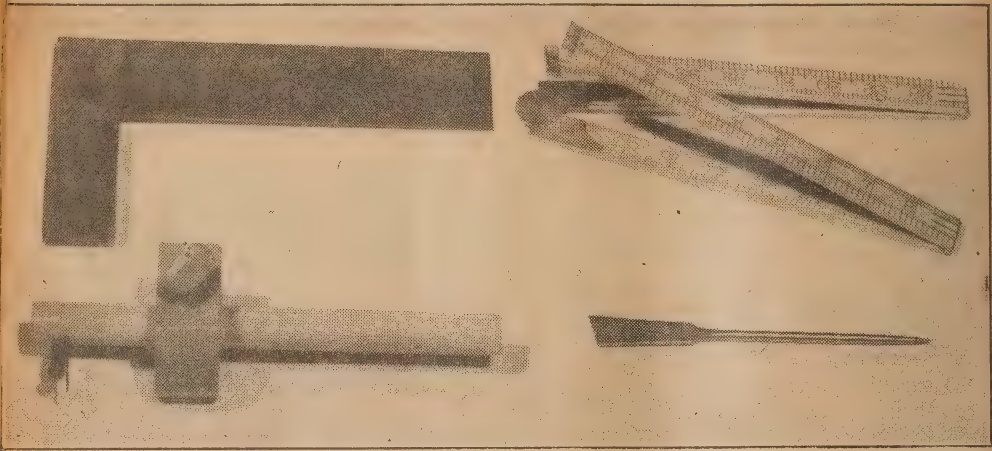
LARGE PROPELLER

The original machine uses a four bladed prop., and you may also use four-blader if you like. However the plans show a simple though no particularly effective propeller whic can be used. Better flight performance can be had by using a reall effective prop. carved according t instructions in R & H some month back, or by securing an appropriate-sized, ready-made one from one of the model supply houses.

It is the propeller that we get well away from scale in a rubber-powered flying model as a true scale propeller is absolutely useless for flight. Fit a nose spinner, as indicated, to nullify, to some extent, the

(Continued on Page 83)

MARKING AND MEASURING TOOLS



Essential tools for marking out a woodwork project. The square is at the top left and directly below it is a cutting gauge. At the top right is a three-foot folding boxwood rule. The marking knife is in the bottom right hand corner.

Every woodworker needs as a basis of his kit a few simple tools for marking out and measuring. The quality of the finished job depends largely on these tools being available and the workman knowing how to use them to best advantage.

THE most essential item is a rule. Carpenters generally use a folding boxwood rule either two or three feet long. In most cases, it folds into one fourth of its extended length by means of brass hinges, but the two-foot rules can also be had in a type which folds once only. This type is more easily broken, and is less to be preferred than the type which folds into four.

All folding rules should be treated with care. If provided with pins on the edge, make sure that these fit correctly before attempting to close the rule. Never throw it on the bench, as the strain placed on the hinges is likely to break them. Even if they are not broken, the hinges are likely to become loose and spoil the accuracy of the rule. In addition, rough treatment is likely to damage the edge.

CARE OF RULE

To save wear and tear on the rule, make a practice of not opening it to measure less than its folded length.

Engineers' steel rules are occasionally used by carpenters for measurements of less than one foot. They will, of course, stand up to much more work, and are capable of being calibrated more accurately than boxwood rules. Steel rules are ofted graduated in sixty-fourths or even hundredths of an inch, while boxwood rules are usually only graduated in sixteenths.

The extra length of the carpenter's rule is, of course, of great value to him, although flexible steel measuring tapes of six, twelve feet, and even greater lengths are now available for accurate measurement of big jobs.

Incidentally, some of the more expensive boxwood rules have a small spirit level included which increases their general usefulness. Some also have a small protractor scale engraved on the hinge so that a rough measurement of angles can be made.

THE TRY SQUARE

Another of the basic tools used by the carpenter is the try square. It is used for setting out and testing right angles. The try square consists of a steel blade which is accurately fixed at right angles to a wooden stock.

The stock is made of some hard tough wood such as English beech or rosewood, which must be well seasoned before assembly to prevent shrinkage or warping. The size of the stock varies in proportion to the length of the blade.

The blade is made of tempered steel, which is usually burned to prevent rusting. The edges must be perfectly straight and parallel if the square is to be fully useful. Most squares have a scale engraved on the blade.

by Maurice Findlay

The stock usually has a brass cover plate screwed to its inner edge to prevent uneven wear. The blade and stock are held together by means of rivets, and the wooden stock is protected from the concentrated pressure of the rivets by a pair of brass rivet plates.

The size of a try square is determined by the length of the blade, and is measured from the stock to the end. It may be anything from three inches to 14 inches. For general work, a six-inch try square is a good choice.

ACCURACY CHECK

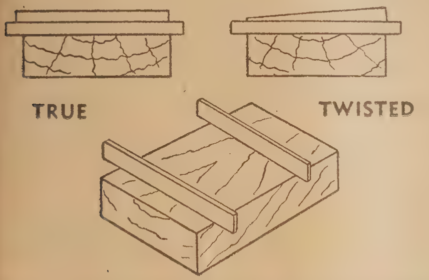
The accuracy of the right angle should be checked occasionally. This can be done with the aid of a piece of wood with a perfectly straight edge.

Press the stock firmly against the edge and mark a line across the face of the wood. Then reverse the square and, with the stock pressed firmly against the same true edge, mark another line to coincide with the first at the edge. If the square is true, the line will coincide throughout its length. If there is an error, the angle between the lines will be twice the error.

Try squares made entirely of metal are available nowadays. They are an improvement on the older type because they are able to retain their accuracy after a great deal of wear. The stock is frequently made of cast iron, to which the spring steel blade is riveted.

Incidentally, a problem which often puzzles woodworkers is that of accurately squaring a line around a piece of cylindrical stock such as a dowel. The trick is to wrap a piece of paper or thin cardboard with a perfectly straight edge around the job until the ends coincide. It is then a simple matter to mark the line with a pencil or marking knife.

The marking knife, by the way, is a most useful item in a carpenter's tool kit. It is about seven inches long and is made from a cylindrical piece of cast steel. One end is pointed and the other flattened and sharpened to form a cutting edge at an angle of about 60 degrees with the axis of the rod.



The check for wind or twist is often forgotten. Two parallel sided sticks or rules are required.

The marking knife is used instead of a pencil where permanent marks or a cut is required. The cut is particularly valuable when marking out for a saw, as it prevents the saw from tearing back the fibres of the wood. With the aid of a marking knife some very accurate and well-finished work can be done by inserting the saw in the cut.

It is very important, in the interests of accuracy, to lean the marking knife away from the straight edge, so that the one cutting face is perpendicular and in contact with the edge of the try square. If the mark is to indicate a saw cut, a second cut can be made slightly to the waste side of the first, and at an angle, such that a small vee-shaped piece of wood is removed for the length of the cut. The saw can then be started in this vee, and will almost automatically be accurately positioned. This applies particularly to small tenon and dovetail saws.

The marking gauge is another valuable item in a carpenter's kit, both from the point of view of the time it saves and the greater accuracy it makes possible. Basically, it consists of a rod with a spur on which is an adjustable stock. The stock is pressed against a true edge, and as it is moved along the spur will mark a line parallel to the true edge at the required distance.

It is essential, of course, that the stock be at right angles to the rod, or stem as it is called, and wide enough to prevent rocking, and hence an inaccurate line.

The marking gauge may be made either from wood or entirely from metal. The former usually have brass inserts, on the stock at least, to prevent uneven wear.

Some quite elaborate marking gauges are available at the present time for special jobs. An example is the mortice gauge, which has two separately adjustable spurs and greatly assists in marking out both mortices and tenons for mortice and tenon joints.

Gauges with special cutting spurs are also available, and they are useful for severing thin strips of timber, cutting trenches for inlay work, and also for cutting small rebates.

Marking gauges with roller cutters which are adapted for marking across the grain, over knots, &c., are also very valuable.

To illustrate the use of some of the tools we have been discussing, we will describe in detail how a carpenter would go about finishing a simple rectangular piece of wood to the required dimensions.

We will imagine, for instance, that an accurately finished piece of wood 12 inches long, six inches wide, and one inch thick, is required, and that a piece of stock approximately 18 inches long, eight inches wide, and 1¼ inches thick is available.

The first job is to inspect the wood on all surfaces and choose the better side for the more conspicuous position in the finished job. Often both sides are free from blemishes, and it is simply a matter of choosing one side or the other to make into a true surface, from which all the other dimensions can be marked.

EXAMINING STOCK

In other cases, of course, it is desirable to select the side which allows the grain of the wood to blend best with its surroundings. In order to inspect the grain, it may be necessary to take a few shavings from the surface to remove dirt or smooth out saw cuts, &c.

If there is any dirt present, take care to remove it before using a sharp plane.

Having selected the side from which to work, the next job is to produce a true surface. With the aid of a rule, plane the side perfectly flat. Incidentally, the side and edge from which measurements are taken are referred to as the "face" side and "face" edge. It is a good idea to mark them for reference.

Although the side may appear perfectly flat when tested with a rule it is still possible for it to have twist or "wind," as it is called. This can be checked with the aid of a pair

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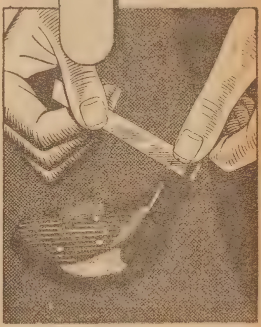

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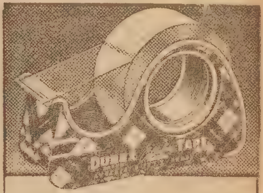

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Front view with panel attached.
With "Plessey" Record Changer .. £39/10/-

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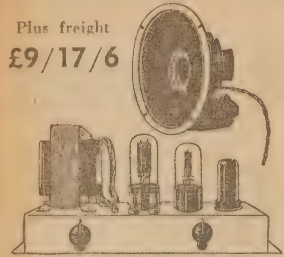

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3-Valve Amplifier with 6" "Rola" speaker suitable for amplifying records in conjunction with a phonograph pick-up—3 watts output. Size of unit without speaker 9" x 4" x 6". Weight 8lbs.

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The Plessey British-made record changer is second to none. Special features are automatic stop, automatic cut-off after playing last record—will take eight records, either 10" or 12", grouped or intermixed.

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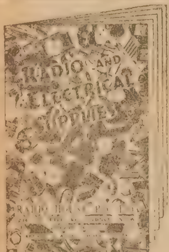
This record player has the following features: plays eight records automatically without attention, either 10" or 12" grouped or intermixed; can be connected to any 240 volt mains power supply, which operates the motor and 4 valve amplifier. The 8" speaker gives ample volume and can be adjusted by means of a control located on the motor board. If desired the unit can be used in conjunction with a microphone for amplifying speech, vocal or orchestral music. Complete in self-contained leatherette covered carrying case, overall size 17½" x 17" x 9" high, £28/17/6.



Owing to the heavy demand for the 80-page Radio and Electrical Catalogue, our supplies have been depleted, and we will not be able to fulfill the many requests for a copy until further supplies of a revised and up-to-the-minute issue is available from the printers. If you would like a copy of this complete guide to radio and electrical parts with a free resistor color code, write to the address below, and one will be forwarded as soon as available. If you have already written, yours will be sent as soon as supplies are received. Either write or cut out coupon below.

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of winding sticks which are often available in a cabinet makers' shop, or if the job is small enough, a pair of ordinary rules with parallel sides can be used. Place a rule on either end of the surface being checked and sight over one rule to the other. When the surface is flat, the top edges of the rules or winding sticks will appear parallel. If not, mark the high corners and continue to remove shavings until the surface is true.

CORRECTING WIND

The next job is to select the face edge and plane it straight and at right angles to the face side. Use the rule to check for straightness and the square to check the right angle. Always use the full length of the plane. Do not attempt to speed up the operation by pushing the plane along at an angle because the benefit of the length of the face of the plane will be lost and the edge will tend to become hollow.

The marking gauge is then set to the correct width (six inches in this case) and a gauge line marked on the face side from the face edge.

Since the wood will now be almost two inches wider than the finished size, it would be a very laborious job to bring it to size with a plane. The more economical procedure is to cut fairly close to the gauge line with a saw. Finish the edge with the plane at the same time checking for squareness with a try square.

Set the marking gauge to the 1-inch position and mark the thickness of the material on both planed edges from the face side. Since there is something less than ¼ inch of waste wood to be removed, planing is about the only possible method.

Check for straightness with a rule but it will not be necessary to check for wind if this has been done properly on the face side.

FINISHING ENDS

If one end of the material is reasonably square it will be possible to mark it with a marking knife and try square and plane it true. If the end is badly off square, a saw cut may save time. In the latter case the marking knife is very valuable because it allows the saw to work very close to the line without the tendency to tear back the fibres.

When planing on end grain, always make a chamfer at one edge and then plane from the other. If this step is omitted the grain will almost certainly break away as the cutting iron of the plane comes over the edge.

Using the try square and marking knife, repeat the procedure at the other end. A saw cut will, of course, be necessary since there will probably be over five inches of waste material to be removed.

The procedure we have outlined for squaring up a piece of wood is basic and other more advanced operations are based on the principles involved.

Having mastered this simple operation more advanced jobs will become simple.

Get hold of a piece of wood and try squaring it up accurately just for practice.

MAN-MADE TORNADOES

(Continued from Page 13)

return circuit back into the compressor. The majority are actually of this latter type, although many non-return tunnels are in use.

Special research problems have led to the development of novel designs. For example, the German tunnel referred to earlier has a 52ft steel sphere at one end, and the air is removed from this by vacuum pumps, the process taking about 10 minutes. When a test is to be made, a valve is opened and suction draws air through the tunnel.

In about 40 seconds, a vacuum is expended so that many completely separate tests are necessary to give a full picture of a missile in flight.

A new 3500 mph tunnel at Princeton University exactly reverses this process. Two 100 hp compressors pump air into a tank, the complete operation requiring several hours. For purposes of testing, the air is discharged into the tunnel through a special nozzle.

A new "straight through" tunnel recently installed in England uses a standard Rolls Royce Nene turbo jet engine to provide the wind current.

The engine, having a static thrust of 5000lb, is mounted in a special nacelle, and the tunnel can be operated for long periods and at low cost, with an air speed verging on the velocity of sound.

At Cleveland, Ohio, the NACA Lewis Laboratory has put into operation a modern tunnel for full-scale testing of aircraft engines. It is of the non-return type, and special control facilities allows the operators to simulate the conditions which would be found at altitudes as high as 80,000 feet. Measuring 8ft by 6ft in cross section, it is said to be the largest tunnel in the world operating at supersonic speeds.

MODEL "MUSTANG"

(Continued from Page 79)

spoiled nose shape occasioned by the oversize propeller.

Being a scale model, at least in some respects, let's dress it up in somewhat the same fashion as the original machine.

Give the entire model two coats of clear lacquer or banana oil and allow to dry thoroughly. When dry, polish with very fine sandpaper and paint complete model, except wheels and prop., with silver lacquer to get that all-metal shine of the original. As a final touch, paint propeller blades and wheels black. The model is now balanced for flight at the point indicated and the use of plasticine on the nose will help to correct any unbalance which has occurred. The ship should fly well on four strands of 1-16in square rubber.

Follow the usual procedure of checking the glide and use only small power on initial hops while making the usual adjustments to secure best flying trim.

Well, there you are, chaps. Is it a scale model, or is it?

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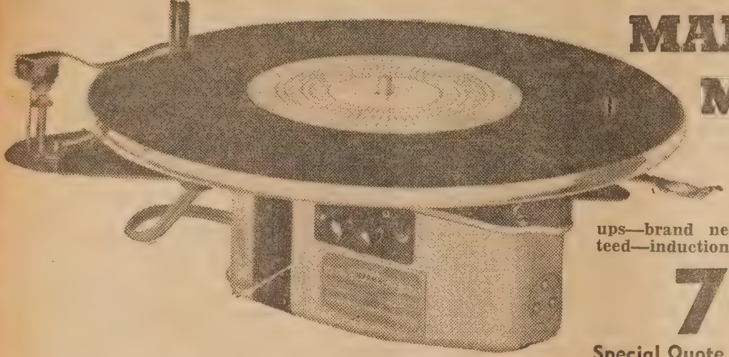

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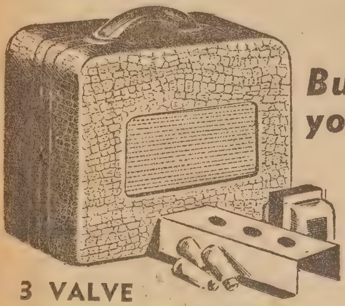

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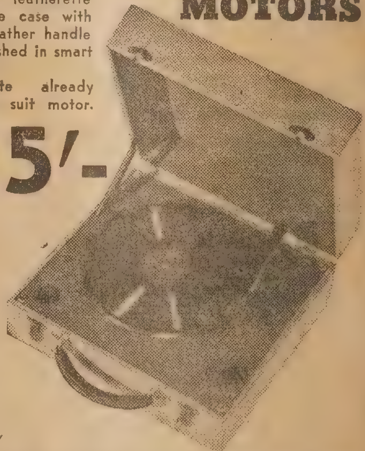

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A COURSE IN TELEVISION

(Continued from Page 51)

Against this, a balanced transformer feed is necessary and only half the available voltage is applied to each diode, thereby lowering the video output across the load.

Figure 6 shows a conventional anode bend detector, as occasionally found in television receivers. The plate load would normally be kept low to offset circuit capacitances, while the resistors in the screen and cathode circuits form a stabilised divider network which ensures that the valve operates on the selected portion of its characteristic.

Occasionally a choke is inserted in series with the plate load to offset capacitive loss, while a low pass output filter or an output trap circuit is necessary, exactly as for a diode detector.

DIFFERENT CONDITIONS

By suitably rearranging the constants, the valve could be worked equally well on its upper bend. Chief effect of this would be to reverse the sense of polarity of the video output signal with respect to earth. However, while the anode bend detector is sometimes encountered, it does not appear to have been favored much by designers and scarcely needs further attention at this stage.

The sense of polarity of the signal from a detector is vitally important, since it has a direct bearing on the number of video stages used and the method of applying signal to the cathode ray tube.

If positive modulation is assumed, an increase in image brightness means an increase in carrier amplitude and therefore a peak of output from the video detector.

In the circuits illustrated (1 to 3), the load is in the cathode circuit and so connected that an increase in carrier amplitude produces a positive-going peak of signal. This is exactly what is required by the grid of the cathode ray tube to produce a picture highlight. Therefore, excluding other factors, the output from the detector, in this case, could be fed directly to the picture tube grid.

"NEGATIVE" IMAGE

However, if video amplification was required, the addition of a single stage would not be satisfactory, since it would reverse the polarity of signals by 180 degrees and turn the positive impulse into a negative impulse. The picture would thus show a shadow instead of a highlight and become equivalent to a photographic negative.

To restore the correct phase it would be necessary to use two video stages or, alternatively, to feed the signal to the picture tube cathode circuit, keeping the intensity grid at virtual earth potential.

With negative modulation, the position is exactly reversed. In this case, a highlight corresponds to reduced carrier output and therefore a reduced positive potential at the cathode of the detector diode. In other words, a negative-going signal.

Reversed through one video stage, this would become a positive-going signal and be suitable for direct application to the intensity grid of the tube.

If the video circuits cannot be arranged conveniently to produce a signal of the correct polarity, the sense of the detector output can be reversed by upturning the diode, as shown in Figure 7a. Alternatively, with transformer coupling, the load may be connected in the diode return circuit (7b), leaving the cathode earthed. The output will then be increasingly negative with rising carrier amplitudes.

The idea may occur to some that a special detector would be required for vestigial sideband transmissions, that perhaps the detector would have to be phased, in relation to the R.F. input, to ensure rectification of the un-suppressed sideband. Such an idea, however, can only be based on a false conception of single-sideband transmission.

Though one half the envelope may be suppressed in the final stage of the transmitter, the modulation envelope which reaches the receiver is symmetrical. The removal of one set of the upper sidebands, however, gives the effect that modulation at high frequencies is only 50 per cent of what it is at the low frequencies.

EFFECTS CANCEL

This is corrected, as outlined in previous issues, by having the carrier fall on one slope of the I.F. response curve. The carrier and low frequency sidebands are therefore attenuated while the upper sidebands are unaffected. The two effects tend to cancel, leaving the detector output substantially independent of frequency.

A good deal remains to be said yet about the d-c potentials generated by the detector and their relation to the video signal amplitude. This will form the subject of another article.

SIMPLE SUPPLY FOR C.R. TUBES

(Continued from Page 37)

If the constructor does not wish to use a standard transformer, transformers designed for such uses as this may obviously be used, or similar items "won" from ex-radar equipment.

In conclusion, it may be considered by some readers that the heater-cathode insulation of the 6H6, really a signal diode, is unlikely to withstand such high voltages for any length of time. The writer would point out in reply, that four such diodes have been in constant use supplying 2000 volts to VCR 97's for over four months and still show no signs of cracking up; proof enough, surely, that they will stand up to it.

A long series of experiments seems to indicate that the point of danger is reached at about 1500 volts, at which figure internal flashover occurred, though there was no evidence that the heater-cathode insulation had suffered even then.

A final word of warning. Do see that your condensers are rated to carry at least the voltages they will be handling and, preferably, more than that. Don't expect an old paper condenser picked out of the junk box to act as a substitute.

Where the input to the 6H6 is 1000 or more volts, and the output is very lightly loaded, it is possible that readers may find flashovers occurring within the valve "pinch." This is due essentially to the input voltage approaching very close to the peak voltage, and the remedy is very simple. Fig. 5 shows the modification to be made where such flashovers occur.

It consists of a high-resistance bleeder arrangement across the input and effectively stabilises the circuit without any appreciable voltage drags.

FOUR MILLION T.V. RECEIVERS

(Continued from Page 7)

wave from New York's channel 4 and pass it on to a wider service area. The future may see more such satellites, some of them perhaps operated automaticaly. Also, we may see a large-scale development of stratovision waves sent out from high-flying planes to areas currently not served."

Coy admits this widening of the voice of single key stations will probably reawaken the old objection to powerful clear-channel radio broadcasts: that they tend to encourage monopoly in the broadcasting industry.

"That is a continuing objection to long-range reception," the chairman said. "However, it seems to us that the obligation of the FCC is to make service available to as many of the nation's homes as possible. We certainly could not justify the disenfranchisement of some citizens because they live in lonely areas beyond the reach of urban television stations."

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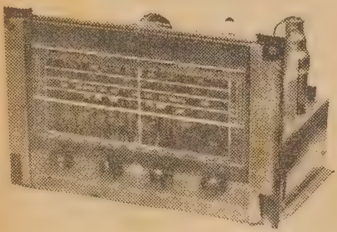

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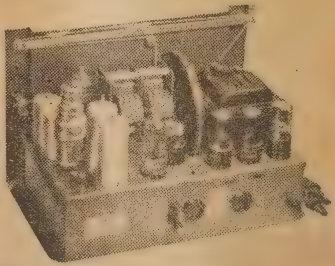

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Automatic record changers can be supplied in place of single players with six or eight valve units. Collaro R.C. 500 with crystal pick-up, plays nine 10" or 12" records £5/10/- extra or Garrard Type 70 with magnetic pick-up £6/10/- extra.

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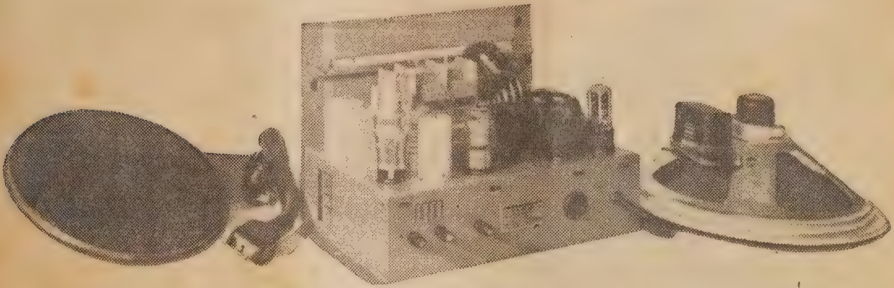

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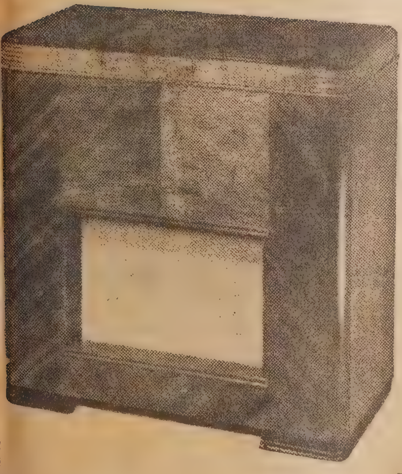

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A SIMPLE FILM STRIP PROJECTOR

This simple film strip projector can be used either as a toy for the children, or for serious lecture work to small classes. It is extremely simple and readers should have no difficulty in adapting the design to suit individual requirements.

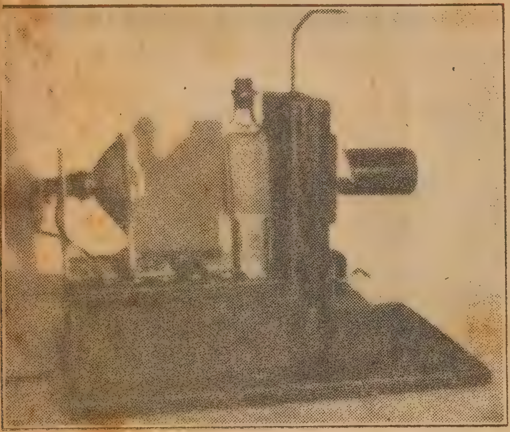

Fig. 2. The projector with lamphouse removed.

AS shown, the projector will throw good 3ft x 2ft pictures at a distance of about 8ft. The gate is designed for downward moving single frame strip, but it could be altered to take horizontal strip or even miniature slides, if desired.

The projector is made chiefly of tin and five-ply wood. The baseboard (Fig. 2) is 14in x 8in, and on this is fixed the lamphouse chassis. This is 7in long by 5in wide and 3in deep with holes along both sides of the top to assist ventilation; both ends are left open, and the inside and the section of the baseboard it covers should be given a coat of dead black paint before fixing to the baseboard by screws from underneath.

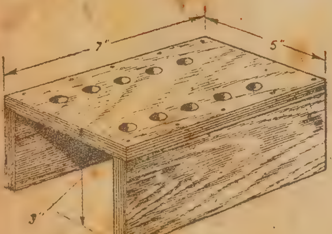

Fig. 1. The lamphouse chassis.

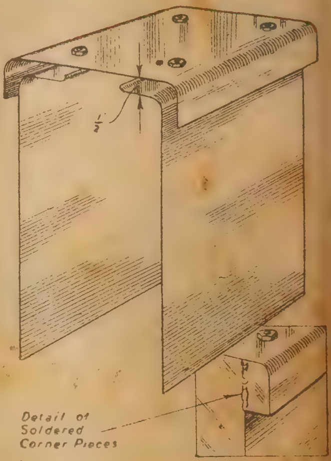
1/2"
Detail of Soldered Corner Pieces

Fig. 4. Details of lamphouse.

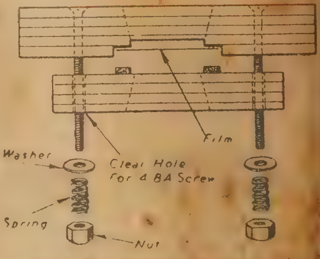
Film
Washer
Clear Hole For 4 BA Screw
Spring
Nut

Fig. 6. Plan of gate and pressure plate.

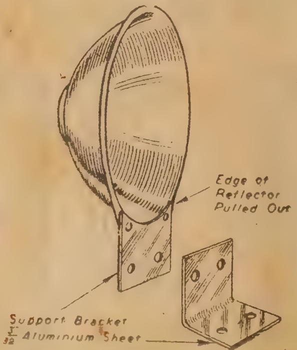
Edge of Reflector Pulled Out
Support Bracket 1/32 Aluminium Sheet

Fig. 3. The reflector and its support.

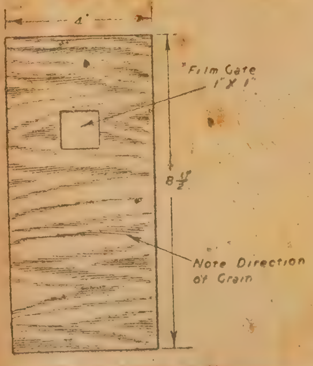
4"
Film Gate 1"x1"
8½"
Note Direction of Grain

Fig. 5. Details of film gate.

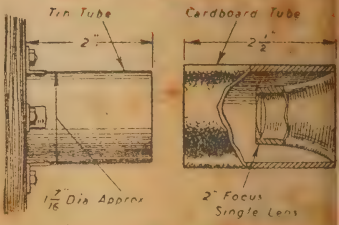
Tin Tube
2"
1 7/16" Dia Approx
Cardboard Tube
2½"
2" Focus Single Lens

Fig. 9. Lens mounting details.

The illustration, Fig. 2, of the projector with lamphouse removed shows the method of mounting the lampholder and reflector; the bottle contains water, slightly clouded; which acts as a diffuser and prevents the burning of the film by the "hot spot" caused by the reflector.

Now a word about the electrical side of the projector. The lamp is a "Lucas Automobile" No. 90 (12-volt 60-watt) fixed in a suitable holder and fed from a transformer. The last two items were obtained cheaply from Government surplus.

A cycle headlamp reflector 3½in diameter and 1¾in deep, correctly focused, directs the maximum amount of light on to the film.

The best position for the lamp will be found by trial and error and the reflector must be able to move around the lamp as well as along the optical axis. This is best done by having the holes in the re-

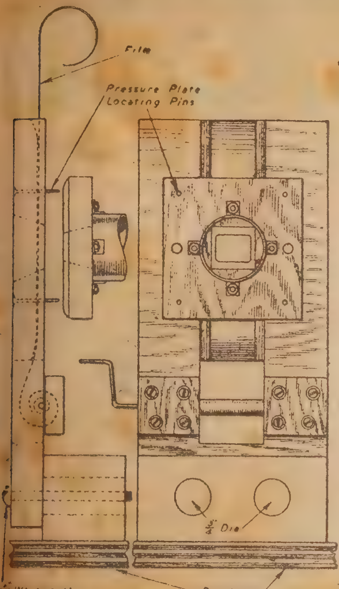

Fig. 7. Side and front views of gate, pressure plate and lens tube mounting.

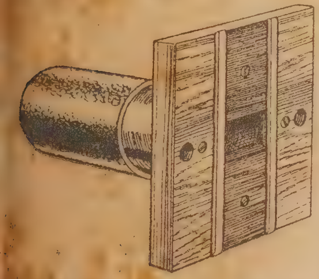

Fig. 8. Projection lens tube and pressure plate.

flector support, Fig. 3, large enough to give good clearance for the screws; the bottle is held firm by the tin case, as shown. By the way, it is necessary to provide a vent hole in the cork.

The lamphouse should present no difficulty. Cut two pieces of medium gauge tinplate 11in x 8½in, bend the 11in side over to a right-angle 1½in from the end, screw both to chassis and place a piece of cardboard about postcard thickness between chassis and tin to allow for easy removal when complete.

The front and back can now be cut 9in x 5¾in and a 1¾in diam. hole cut in the front end 6in from the bottom; the ends can now be soldered to the sides, which are attached to the chassis.

The lamphouse top can be cut and shaped and then fixed with four 3-16in Whitworth screws to the lamphouse sides with ½in distance pieces inserted (see Fig. 4) and soldered to the lamphouse ends.

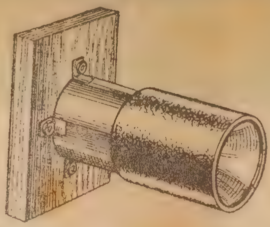

Fig. 10. Projection lens tube and mounting.

To make the light trapping more effective, four small pieces cut to shape can be soldered in position as shown in the inset, Fig. 4.

The film gate of five-ply wood measures 8½in x 4in. Before cutting, make sure the grain of the top layer runs across (see Fig. 5) so that when a layer 35mm. wide is cut out, the layer underneath runs from top to bottom to give a smooth track for the sides of the film strip.

A further layer the width of picture area can then be cut out.

The idea to follow is that during the passage of the film down the gate only the sides are touching, nowhere does the picture area come in contact with the gate or pressure plate (see Figs. 6, 7). The winder shaft should be friction held. For the roller, part of a cigarette machine roller was used, and being made of hardwood it stood drilling without splitting. A spring clip out of an electric kettle connector was found ideal for holding the film on to th roller.

The gate is fixed to a piece of hard wood, 1¾in square and 6in long, wit ¼in Whitworth screws, the holes i hardwood allowing enough clearanc for the final lining up of the optica axis.

The pressure plate measures 3i x 3in, and its construction is clearl shown in Figs. 6, 7, 8.

The projection lens is a watchmaker's eyeglass of 2in focu mounted in a cardboard tube, which should be a sliding fit on the tube attached to the pressure plate. Fig 9 shows the approximate lens mounting sizes for a 2in lens.

The lens aperture should be "stopped down" to about ¼in. The amount of stopping down required to ensure good definition will depend on the quality of the lens.

The adjustment of the projector when complete should be in the following order; arrange the lamp and reflector on the lamphouse chassis so that the beam of light will pass through the centre of the hole in the lamphouse front, then move the combined film "gate" pressure plate-cum-lens panel, so that an evenly-lit screen is obtained.

Give a coat of dead black paint to all parts where it is necessary to cut down light reflection. Finally, there may be variations in construction to suit personal tastes and materials available, but the projector described will give good results if the necessary care to work to reasonably fine limits is taken.

The Australian

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1950 Edition

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ON SALE SOON

SHORT WAVE NOTES BY RAY SIMPSON

NEW BRITISH STANDARD FREQUENCY STATION

All the short wave listeners are aware of station WWV in Washington and WWVH in Hawaii which are operated by the United States Bureau of Standards for the purpose of providing accurate time signals and frequency measurement facilities.

BOTH these stations have been heard in Australia at very good strength on 5, 10, 15, and sometimes 20 mc. A recent innovation is the announcing of the time each five minutes instead of on the hour and half hour as previously. In addition to providing the exact time, these stations are always useful in providing a marker point for receiver calibration.

We now have a new frequency measurement station, this time from England, and once again Art Cushen was the first to report this newcomer. In fact, not only was he the first to tell us about it, but also he has received his verification from the station already. In their letter of verification they told Art that his was the first report received from any distance and we would like to congratulate him on this very fine achievement.

This new station using the call letters MSF is at present conducting experimental transmissions on 5.0 mc and 10.0 mc at the following times:—3.44 pm to 4.15 pm on 5.0 mc and from 4.29 pm to 5.0 pm on 10.0 mc.

ON 30 METRES

At the time of writing these notes we have not heard MSF on 5.0 mc but it can easily be logged on 10.0 mc from 4.29 pm when they give station announcement and state that the station is operated by the National Physics Laboratory at Teddington, Middlesex, England, and ask listeners to advise them as to how the station is being received. In this announcement they also mention another frequency which is in use from 8.29 pm to 9.0 pm but we have been unable to catch what frequency they give. In their verification to Art Cushen they advised that they were using a power of 10 kw and also sent him special reception graphs to be filled in for further reports.

After the initial voice announcement they put on a tone of 1000 cycles per second and this continues as far as we can hear till the station closes half an hour later. At this particular time, that is between 4.29 pm and 5.0 pm, WWV is coming in at great strength and naturally this makes reception of MSF rather difficult. We would advise listeners who wish to hear this station to be sure to listen at exactly 4.29 pm as during that minute the tone is off from WWV and MSF are making their announcement which is also repeated when the station closes at 5.0 pm.

SOUTH AMERICA

OAX4V "Radio America" in Lima, Peru, can often be heard on a Sunday afternoon on 5.91 mc with typical dance music while on some days another Peruvian, OAX4Q "Radio Victoria" can also be heard on 6.01 mc but not quite as strong. Around 10.0 pm is the best reception period for these stations and at that time we have LRM on 6.18 mc in Mendoza, Argentine, not to mention HOB "Radio Panamericana" on 6.2 mc and CE622 on 6.22 mc in Santiago, Chile. On some nights you can also hear HC1AC in Quito, Equador, when it operates on 6.21 mc. This last station can easily be recognised by its announcement "Voz de la Democracia." The Gautemalan stations are now excellent at the time mentioned and the best of these are TGTO "Radio Internacional" on 6.285 mc, TGLA "La Vox de Centroamerica" on 6.295 mc, TGTA "Radio Bolivar" on 6.32 mc and TG2 "Radio Morse" on 6.62 mc.

Possibly the loudest of these Latin American stations on this portion of the band is YSUA in San Salvador, El Salvador, which comes in at great strength on 6.27 mc and quite often gives their announcement of YSUA "Radio Mil Cencuenta." On occasions you can also hear YSR on 6.275 mc.

There is also a Nicaraguan station on this portion of the band, this one being YNAS "Ondes del Xolothan" which can be heard just above TGLA on 6.305 mc. The good old standby, COHI in Santa Clara, Cuba, can always be heard on 6.45 mc announcing as "Cadena Azul."

Moving now toward the 41 metre band there is YNVP on 6.76 mc "Voz de Nicaragua" though this one is not always audible. Much more reliable is YNEQ "Voz de Victoria" on 6.96 mc which gives some very good musical numbers.

31 METRE BAND

Before actually entering the 31 metre band there are the Cubans such as COJK in Camaguey on 8.665 mc, COCQ in Havana on 8.825 mc, COKG in Santiago on 8.955 mc, COCX on 9.27 mc in Havana, COBC also in Havana on 9.36 mc and COCH another Havana station on 9.435 mc. There are also two very good Peruvians on this portion of the band, OAX4J "Radio Colonial" on 9.33 mc which can often be heard till as late as 6.0 pm at very good strength and OAX4W "Radio America" which carries the same programme as OAX4V but which operates on 9.375 mc and is heard best around 4.0 pm on Sundays.

The first station in the 31 metre band proper is our old friend XEWW in Mexico City which now comes on the air at 10.0 pm on 9.5 mc and blots out DZH3. This station is really good on most nights. Next we have another Cuban COCO which can just be separated from nearby stations when it opens at 10.0 pm on 9.53 mc. They also mention a number of other stations in their opening announcement.

Chile is our next stop and here we have CE960 on 9.595 mc announcing as "Radio Americana" and giving some very high quality recordings. HP5J in Panama operating on 9.605 mc can sometimes be heard at 10.0 pm but not nearly as well as TIPG "La Voz de la Victor" in San Jose, Costa Rica, which is really superb, opening at the same time on 9.62 mc. Back again to Panama you can just hear HOJA on 9.645 mc jammed in between Manila and the American.

They can be recognised by their slogan "Radio Provincias" and frequent mention of Panama. Another old timer is XEQQ "Radio Panamericana" in Mexico City, which uses 9.68 mc from around 11.0 pm opening with Ravel's "Bolero." On the same frequency in the morning you can sometimes hear H12A in the Dominican Republic city of Santiago de los Cabelleros.

When the morse interference is not too severe there is quite a good signal from the Brazilian PRL7 on 9.72 mc which carries the same programme as PRL8 on 11.72 mc. Always one of the loudest Latins is H12T in Trujillo, Dominican Republic, which operates on 9.735 mc in parallel with H14T on 5.97 mc which can also sometimes be heard. Listen any afternoon for TGWA on 9.76 mc with their distinctive marimba type music, though better still, listen for the same station at night around 11.0 on 15.17 mc.

ZYB8 in Sao Paulo, Brazil, is coming in nicely now on 11.765 mc around 8.0 pm while LRT in Tucuman, Argentine, is excellent when it opens at 8.0 pm. Space will not permit us covering any more this issue but next month we will list some others which have been heard in New Zealand during the past few weeks.

SHORT WAVE NOTES for the July issue are due on June 10. For the August issue they are due on July 8. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, N.S.W.

SHORT WAVE STATION ADDRESSES

IT is some time now since we gave you any station addresses and they are always useful for those listeners who wish to send reports on their listening. We now give you a few more to add to those you already have listed.

HER5 The Swiss Broadcasting Service, Nuengasse 28, Berne, Switzerland.

SB0 Radio Sweden, Benergaten 37, Stockholm, Sweden.

CS2MK Emisora Nacional de Radioifusao, Rua do Quelhas 2, Lisboa, Portugal.

OZH The Danish State Radio, Radiohuset, Rosenornsalle 22, Copenhagen, Denmark.

CR6RL Radio Clube de Angola, P.O. Box 229, Luanda Angola.

OTC Radiodiffusion National Belge, P.O. Box 505, Leopoldville, Belgian Congo.

SUX Egyptian State Broadcasting, Broadcasting House, Cairo, Egypt.

FZI Radio Brazzaville, P.O. Box 108, Brazzaville, French Equatorial Africa.

EPB Director General, wireless Department, Ministere des Postes Telegraphes & Telephones, Teheran, Iran.

Kol Yisrael. Department of Broadcasting (Kol-Yisrael), P.O. Box 17, Hakirya, Tel-Aviv, Israel.

TAQ Turkish Press Department, Radio Branch, Ankara, Turkey.

HLKA Korean Broadcasting System, 1 Chung Dong, Seoul, Korea.

B.F.E.B.S. British Far East Broadcasting Service, P.O. Box 434, Singapore, Malaya.

Radio Malaya. Radio Malaya, Department of Broadcasting, Cathay Building, Singapore, Malaya.

HS8PD The Overseas Broadcasting Station, Publicity Department, Bangkok, Siam.

VERIFICATIONS

VERIFICATIONS have been rather like new stations, not too many of them, but those we have heard of are listed as a guide to what others may expect to receive.

BED7, CHINA: Quite an interesting letter has been received from Mr. Chang Shui-yo confirming reception of station BED7 on 7.15 mc. He states that BED7 is a part of "The Voice of Free China" and is in parallel with BED2 on 670 kc and BED34 on 860 kc. He also advises that the other part of the Voice of Free China broadcast over BED2 has, since April 1, been changed to 15.235 kc. This latter transmission is beamed to the USA.

RADIO FRANCE ASIE, SAIGON: Art Cushen has recently received a very interesting letter of verification from Saigon confirming his reception on 11.84 mc. The writer, M. Jean Pipon, says "The Voice of Vietnam" commenced operations on January 1; and as Vietnam did not like Saigon included in the announcements, the call of Radio Saigon was changed to "Radio France—Asia, The Voice of France in the Far East." Radio France—Asia is still a purely French station and quite independent from Vietnam.

Despite this however, Monsieur Pipon does edit and have a Radio France announcer give the present English News Session at 9.15 pm from Vietnam. Apart from this support however, he explains that they are quite different stations.

He states that they are now operating on 11.84 mc but in the schedule he enclosed and which we publish below, they give their frequency at 11.83 mc.

English.—9.45 am to 10.0 am, News. 11.83 mc, 10.30 am to 11.0 am, Music, News. 6.165 mc, 11.83 mc, 7.15 pm to 9.0 pm, Music, News. 11.83 mc, midnight to 1.12 am (news midnight) 11.83 mc.

ZUD32, SOUTH AFRICA: The last verification for the South African stations used for the sports relay to New Zealand has just come to hand. This last one was for ZUD32 on 17.39 mc, by Air Mail from the Postmaster at Pretoria.

YDF2, JAVA: We have often mentioned that it is not wise to give up hope of receiving your verification just because it is a long time since you sent your report, and a recent letter received from the Head of the Technical Department of Radio Indonesia adds weight to what we have already said on this matter.

His letter was primarily to confirm reception of YDF2 on 11.785 mc but at the same time he also verified reception of YD12 on 4.37 mc and YD13 on 7.295 mc the report having been sent on February 23, 1949. Two other stations were also verified, YDP2 on 7.36 mc (report August 17, 1949), and YDJ2 on 7.1 mc.

NEW STATION LOGGINGS

Call	KC	Metres	Location	Time Heard
MSF	5000	60.00	Teddington, England	3.45 pm
HO50	6040	49.67	Panama City, Panama	2.30 pm
KRCA	9515	31.53	Dixon, Cal., U.S.A.	7.00 pm
KRCA	9650	31.09	Dixon, Cal., U.S.A.	7.00 pm
KRCA	9700	30.93	Dixon, Cal., U.S.A.	5.15 pm
MSF	10000	30.00	Teddington, England	4.29 pm
WRCA	11770	25.49	New York, N.Y., U.S.A.	8.00 am
I2RO13	11900	25.20	Rome, Italy	6.30 am
KRCA	15130	19.83	Dixon, Cal., U.S.A.	5.15 pm
KRCA	15250	19.67	Dixon, Cal., U.S.A.	3.30 pm
KCBR	15310	19.60	Delano, Cal., U.S.A.	3.30 pm
WRCA	17780	16.87	New York, N.Y., U.S.A.	8.00 am
KRCA	17830	16.83	Dixon, Cal., U.S.A.	7.00 pm
WRCA	21610	13.88	New York, N.Y., U.S.A.	8.00 am

NEW CALLS HEARD IN MAY

MAY was not a very prolific month in the way of new stations and this seems to have been the case with most listeners. However there are a few which no doubt most of you have already heard but which we chronicle here for the benefit of those listeners who may have been too busy to go after the new ones.

USA: The biggest bunch comes from the USA where we have a very powerful addition to the short wave bands in KRCA which has been logged on six different channels and in the majority of cases at exceptionally good strength. One of the loudest is the 9.7 mc outlet used in the United Nations transmission opening at 5.15 pm while at the same time they are also transmitting in 15.13 mc.

Three other frequencies are used by this station when it comes on the air with the Voice of America programme at 7.0 pm; these are 9.515 mc, 9.65 mc and 17.83 mc. The first two are really excellent though the 17.83 mc channel is very weak on most nights. Still another KRCA outlet is 15.25 mc which is used in the afternoons from 3.30 pm with the AFRS sessions, this, too, being very loud.

We have also noticed KCBR using a new frequency in the 19 metre band, this time being 15.31 mc, while the East Coast station WRCA also appears to be using changed frequencies as they can be heard daily till closing at 8.15 am transmitting on 11.77 mc, 17.78 mc, and 21.61 mc. These transmissions are the European service of the Voice of America.

ITALY: The Italian Broadcasting Service is now using an additional frequency in the 25 metre band, 11.9 mc. This new one carries the same programme as heard on 9.63 mc and 11.81 mc and until 6.45 am consists of a programme in Arabic followed by programme in German which is still heard till well after 7.0 am.

The 11.9 mc station is very much louder than the one on 11.81 mc and is so good in fact we think it possible they may be using a new transmitter with an increase in power. It is possible that this station is also being used at other times and may carry programmes in English, but at the time of writing, the morning session is the only one being heard at our location.

PANAMA: Art Cushen has been having a really good time with the Latin Americans during the past few weeks and amongst those he has heard is a new one in Panama. This station uses the call sign HO5O and is known as "Radio Continental" and is located in the capital, Panama City. They are operating on 6.04 mc and were heard with news in Spanish at 2.30 pm and left the air at 3.0 pm.

Unfortunately this is rather early for us in Eastern Australia but it is worth while listening for them on a Sunday afternoon during the winter as on some occasions they may remain on the air till after 3.0 pm with a late Saturday night programme in Panama City. A few months ago we heard a Panama station on this channel but as far as we remember we did not identify it at the time so it may be HO5O.

FLASHES FROM EVERYWHERE

ENGLAND: The International Short Wave Club is conducting a world-wide census of opinion to discover which is the most popular short wave station or service. They have requested all short wave listeners whether members of the club or not to send along a list of their five most popular stations in order of popularity. This census will be of great interest and the results will be published and also communicated to the stations concerned.

Make out your list of five stations and send it along to the club at the address shown, International Short Wave Club, 100 Adams Gardens Estate, London, S.E.16, England. It will be interesting to see which is the most popular station.

FRENCH SUDAN: A few months ago we published a paragraph concerning a station located in the above country and which was reported to be operating as Radio Bamako. According to the latest issue of Radio News and Television, the station has now advised an American listener that they operate on 15.03 mc with an output of 2 kw. The station is Government controlled and only operates at irregular intervals giving meteorological forecasts, Government and industrial news and occasionally musical items. According to one list we have, the call letters are given as FGJ9 and this seems to be confirmed by another report we have seen concerning the same station. We still have no reports of its reception in Australia.

CAMEROONS: Radio Douala has been reported on and off for quite some time now but we do not recollect hearing of anyone in Australia who has received a verification from the station. It was therefore quite interesting to see by Radio News that an American listener had just received a reply from the station in 17 days. In their letter the station gave frequency as 9.15 mc using a power of 600 watts with a delta antenna oriented NW-SE.

They also advised that they would have a new 1 kw transmitter in use some time this year and would then change their frequency to 7.278 mc and would appreciate reports from those listeners who were able to hear them. We think their present channel of 9.15 mc would be better thatn 7.278 mc so far as we are concerned.

SWEDEN: In a recent issue of Sweden Calling DX-ers they give the new schedule for Radio Sweden which was to come into effect as from May 2, and continue until July 30. This schedule reads as follows:—10.0 am to 11.30 am on 10.78 mc and 15.155 mc; 3.15 pm to 5.30 pm on 6.065 mc and 15.155 mc; 5.30 pm to 1.15 am on 11.705 mc and 15.155 mc; 1.15 am to 8.0 am on 10.78 mc and 15.155 mc.

These times of transmissions are not exact as there usually are intervals on week-days at 5.30 pm to 9.0 pm and from midnight to 1.15 am. In addition to the above they also state that the first transmission of "Sweden Today" will as from May 2 be at 10.15 pm on 10.78 mc and 15.155 mc and also at 11.0 am on the same two channels. Incidentally, Radio Sweden now sends out a very attractive all English verification card.

BRAZIL: Seasonal changes have also made necessary an alteration in the transmitting times and frequencies of some of the Brazilian stations and as from May 1 the following will be the schedule of Radio Jornal do Commercio in Pernambuco. These new times will continue in use until Navember 30. ZYK2 on 15.145 mc from 7.55 pm to 5.0 am; and ZYK2 on 6.085 mc from 7.am till noon.

Their other station, ZYK3 will operate on 9.565 mc from 7.55 pm till 3.0 am and again from 5.0 am to noon on the same frequency. Speaking of Brazilian stations we notice that ZYC8 "Radio Tamoyo" on 9.61 mc is coming in fairly well around 8.0 pm when not blotted out by Perth while ZYB8 "Radio Tupi de Sao Paulo" is very good at the same time on 11.765 mc.

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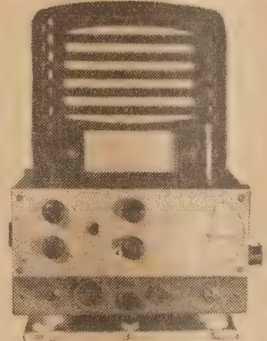

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THE HAM BANDS WITH BILL MOORE

Conventions give amateur radio enthusiasts an opportunity of cementing friendships made via the ether. To the country amateurs these opportunities do not come very often, but when they do as happened on the North Coast recently, they travel hundreds of miles to meet others of the fraternity.

THE major country amateur event of the year in NSW was the WIA's North Coast Convention at Urunga over Easter, when 70 members and their families gathered together there for the meeting. A programme to suit all sections had been arranged, and the weather eased for the holidays to allow the visitors to enjoy fully the entertainment.

Local bodies co-operated to make the convention a success, and they included the Progress Association, surf club, football club, anglers' club, the Chamber of Commerce, and the Bellingen Shire Council.

It was the view of everyone present that next year could easily see 250 present at the convention.

The convention officially opened at 2.0 pm on Easter Saturday, and the following amateurs attended—VK4CU, 4CZ, 4ST, 4UX, 4TY, 4XP, 2AAP, 2AAM, 2AAN, 2ACU, 2ADE, 2ADN, 2AEU, 2AEY, 2AGD, 2AGM, 2AHA, 2APB, 2AJT, 2ALB, 2AMJ, 2ANA, 2ARJ, 2ARY, 2ASF, 2AWS, 2AWG, 2AYE, 2GM, 2DK, 2DX, 2EA, 2GI, 2JC, 2JR, 2JK, 2KR, 2LH, 2MM, 2OE, 2PA, 2RK, 2TL, 2UC, 2UY, 2WQ, 2WT, 2XO, 2XP, 2ZC, plus a large number of associate members of the WIA. There were, of course, also there many YL's YF's and harmonics of the members.

In a fitting finale, Crieff Rettalick, VK2XO, who was responsible for much of the organisation, was presented with a Bendix Frequency Meter, in appreciation of his efforts. The presentation was made over VK2W1, by Bob Long, VK2MM.

The whole convention was very well run. The townsfolk fully co-operated, and after two conventions they no longer look askew at the antics of amateurs rushing about with equipment that would have done credit to many comic strips.

WIA News

THE 20th Annual Federal Convention of the WIA was held in Melbourne over Easter, and amateurs from all States assembled to debate the problems of the Australian amateur. Forty-one agenda items were voted upon, and 11 general business discussed.

Quite a portion of the proceedings was recorded on wire, and this record will be made available to the divisions.

Members of the Federal executive present at the convention were: The Federal president, W. Gronow, VK3WG; Federal vice-president, G. Glover, VK3AG; Federal treasurer, P. Evans, VK3OZ; Federal publicity officer, G. Manning, VK3XJ; Federal secretary, M. Hull, VK3ZS; and the retiring Federal secretary, W. Mitchell, VK3UM.

Divisional delegates were:—NSW: J. Moyle, VK2JU. Victoria: C. Gibson, VK3FO. Queensland: V. Jeff, VK4VJ. South Australia: H. Austin, VK5AW. Western Australia: G. Moss, VK6GM. Tasmania: J. Brown, VK7BJ.

Observers from NSW and SA: J. Corbin, VK2YC, and G. Bowen, VK5XU, were also in attendance. Allan Brown, VK3CX, acted as recording secretary.

The decisions reached will be presented to the divisions in the minutes, and they will appear in due course in the official organ, "Amateur Radio."

The results of the elections for the council of the NSW division, saw several newcomers to official positions take office.

The seven councillors elected by a State-wide ballot were: M. Brown, VK2OR; M. Butler, VK2AAN; J. Corbin, VK2YC; D. Evans, VK2AYE; J. Moyle, VK2JU; W. Nye, VK2XU, and V. Wilson, VK2VW.

Councillors to be re-elected were: Maurice Brown, VK2OR, and Vaughan, Wilson, VK2VW, the latter is well known as NSW UHF officer, and he presents the VK2WI broadcasts each Sunday morning.

Three old-timers make a re-appearance on the council. They are: John Moyle, VK2JU, Federal councillor, Jim Corbin, QSL officer, and Wal Nye, VK2XU, late secretary of the division. They bring to the council a wealth of general knowledge on amateur affairs and the WIA. Their previous experience in office should do much good in framing the policy for the year.

The secretary, Maurice Butler, VK2AAN, and assistant secretary Dave Evans, VK2AYE were ex-offico members of the council last year, and are now councillors. They both did excellent work in the past, and are certain to continue in similar vein. All seven will undoubtedly find most of their spare time used up watching and working in the interests of the NSW radio amateur, and it is only hoped that these efforts will not go unheeded.

The UHF's

THE NSW division of the WIA held a very successful UHF field day on April 16, and a large and enthusiastic number of amateurs participated. They were active on 144 and 576 mc/s.

Most activity was in the suburbs, but VK2IT, 2YM and 2ANF, ventured to Mt. Gibraltar, near Mittagong. They used the Gladesville club's call, VK2ADY/1. They reported outstanding signals on 144 mc/s from Sydney were VK2AH and VK2AWZ, the latter operating portable on the hills north-west of Sydney.

The greatest problem was to separate the stations from the city. 576 mc. was tried out also, but no other stations were heard. An effort was made to contact Cessnock, 125 miles away, on 144 mc, to repeat a contact made by VK2BG, some months before, but without success. Eleven stations were worked from the "gib" on 144 mc. during the day. The beam array attracted oldtimer, ex VK2SK, who showed quite a lot of interest. Thirty stations were active in the area around Sydney.

After the initial openings between Victoria and Tasmania, on 144 mc. during late March, a large number of stations in both States have been standing by for further contacts, and they were successful, too, on a number of occasions.

UHF DX in Europe on 144 mc. has been quiet, and the best working on that band for a number of months was a contact between G2BMZ in Torquay, England, and PAOEO, in Holland, the distance 384 miles.

Horizontal versus vertical polarisation

OVERSEAS NEWS AND COMMENTS

THE position with the new regulations in the US is still very confused, considering the wide diversity of opinion being expressed. The two "National" societies, originally called with the ARRL to the initial FCC hearing, have in a period of a few months completely reversed their opinions. The National Amateur Radio Council and Society of American Radio Amateurs met with the ARRL and decided to oppose certain sections of the proposed regulations. They now fully support the changes originated by the FCC. It is apparently the old story, often experienced in societies, and unfortunately in amateur bodies here too. The men who do all the work can't find time to talk, while those that do all the talking haven't time to work. The arguments put forward are not based on experience but rather on inexperience.

Some new DX awards have appeared recently, one at least is a change from the normal issuing of certificates. The periodical "Radio Onda" of Argentina, through it's DX Editor, LU8BF, offers a sheepskin to all local and foreign amateurs who submit a list showing contacts with 50 countries.

If you require a sheepskin, write LU8BF, Cerrito 1222, Buenos Aires, Argentina. The list should show whether the contacts are on CW or telephony, and should be certified as correct by the WIA here in Australia.

On more conventional lines is the WAA certificate issued by the Brazilian National Society, the LABRE. If you can produce cards showing contacts with 45 different countries in North and South America, you would qualify. There are some 57 different countries in the area, but when you delete some of the 6-VP8's, FP8 St. Pierre, and a few others, it will be found to be a very difficult award to win. Cards should be sent to LABRE, HQ, PO Box 2353, Rio de Janiero, Brazil.

A similar award, with the same initials, WAA, but denoting Worked all Africa, instead of Worked all America, is being issued now by the South African society, the SARL. Cards should cover all ZS call areas, 1 to 9, plus 25 other countries on the continent of Africa. The certificate is issued at a fee of 2/6 on application, to SARL, PO Box 7208, Johannesburg, South Africa.

The above awards require that sufficient postage reply coupons should be forwarded for the return of the certificate, as for the sheepskin, no mention is made of postage.

The days of the "Corn-fed" Californian kilowatts are apparently numbered, in view of a recent FCC announcement. The commission points out that amateurs should not be misled into thinking that station inspections are necessary to check the input to the final valve. The application of the new continuously recording field intensity meters allow inspectors to check and obtain information on any station. The FCC can make a recording of field strength from any amateur station, and such data, accumulated, constitutes legal evidence.

The FCC can then take any steps they consider necessary to follow up the information gained. A check of field strengths for fixed inputs might tell quite a story. The revolving of the rotary would cause some rapid fluctuations on the FS meter, but you would only have to turn the beam in the right (or wrong) direction for a second for the required recording to be made.

YOUR CALL SIGN

HAVE you a new call-sign? Have you you recently changed your address? If so, you are requested to advise us immediately, so that it will appear correctly in the new edition of the Australian Short Wave Handbook. Address your letter to the Editor, Radio and Hobbies, Box 2728C, GPO, SYDNEY.

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In new condition. Including instruction book, valve chart, etc.

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Including 500 micro - amp meter.

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Mark 3, Carbon, new and tested.

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No. 11 AERIAL RODS

¾" diameter. 3', 4' and 6' lengths. Screwed ends.

1/- per foot

GENEMOTORS

Input	Output		
12 volt,	250V,	60MA,	£1/10/-
12 volt,	550V,	160MA,	£4/10/-
12 volt,	345V,	50MA,	£1/10/-
12 volt,	275V,	110MA,	£3/10/-
24 volt,	250V,	60MA,	£1/10/-
24 volt,	300V,	250MA,	£2/ 5/-
24 volt,	350V,	200MA,	£3/10/-
24 volt,	550V,	160MA,	£3/10/-
32 volt,	275V,	100MA,	£3/10/-

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Coastal ships' equipment. Crystal controlled. 12 volt powered. Less Valves.

£8/10/-

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A vernier adjusted level. Calibrated in degrees & minutes.

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4 band aircraft receivers, 8-valves operating from 24 volt D.C. but converts easily to A.C. coverage. 150 k.c. to 10 meg. missing broadcast band. Complete with valves.

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13 valves, Genemotor, Relays. New Condition.

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New low impedance.

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1in O.D. to 12ft length

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EXCELAIR RADIO

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FOR THE BENEFIT OF DISTANT PATRONS—PHONE ATTENDED TILL MIDNIGHT for UHF arrays is again in the news, and a number of American stations have been conducting exhaustive tests to try and decide which is the better.

W3KE, for instance, erected two 32 element beams back to back, one vertically polarised, the other horizontal. Both teams showed gains between 16 and 18 DB and after tests covering some months, it was decided that horizontal polarisation was to be preferred by a slight margin. This seems to be the general concensus of opinion.

Openings between North and South America on 50 mc. have been occurring frequently, and American stations have worked into YV, LU, HC and OA. To help the W stations make the most of unusual conditions, WIAW, official station of the ARRL, broadcasts nightly, information on anticipated ionospheric storms.

IARU Celebrations

THE 25th anniversary of the formation of the International Amateur Radio Union was celebrated in Paris during mid-May. Delegates and amateurs from many European National Societies were present at the Congress.

The arrangements were made by the REF, the French amateur society, and the congress was opened by M. Georges Barba, F8LA.

Besides the general entertainment that amateurs afford one another, two committees were set up.

The first considered legislative problems and covered variations or regulations of the different European countries, with a view to a better understanding of the problems entailed. They also arranged for representation of the European societies at the forthcoming Telecommunications Conference to be held at Buenos Aires in 1952. A scheme of band planning—telephony and CW—was also debated upon, besides covering other general problems.

The second—a technical committee—discussed the many problems of TVI and interference generally, UHF and VHF propagation, and scientific observations.

The results of the committee's decisions will be published, and copies forwarded to all IARU societies for information.

A special commemorative postcard to celebrate the founding of the IARU will be issued by the French Posts and Telegraph Department, with a special stamp on one corner, a sketch of a three-element rotary beam on the other.

Some hundreds of amateurs, mainly from Great Britain and France, attended the congress.

DX and Personal

CHOICEST piece of DX for many moons appeared during April in the form of HC8GRC on the Galapagos Islands, west of Ecuador.

The station was fitted out by the Radio Club of Ecuador, so the DX fraternity would have an opportunity to contact the Islands. A special decorative QSL card will be printed, and cards should be sent to the operator, HC2JW, or via the bureau. HC8GRC was active on both CW and telephony, and many Australian stations took the opportunity of adding another one to their list.

The Russians now have their QSL cards printed entirely in Russian, and UA3DE's callsign, looks like YA3?? The change was apparently by regulation, but most of the Russians are sneaking the Anglicised version of their call somewhere on the card.

Quite a number of rumors on the future of the 21 mc. band have been in circulation. Some startling ones have arrived from the US, and they suggest we have lost the band, before we really have obtained it. To date no specific information on any change is available, but in these days of high-pressure short-wave broadcasts to the USSR, &c., anything might happen.

Of all amateur radio workers, perhaps the QSL managers have a job that keeps them busy all the time. Ray Jones, VK3RJ, Federal QSL officer last year, handled 56,000 QSL cards, a mere 130 a day. After many years in the position, Ray still gets a pleasant reaction when some choice DX card turns up.

Bill Mitchell, VK3UM, Federal secretary of the WIA for most of the post-war period, soon leaves for England for a two-year stay. Bill, a very solid and always busy WIA worker, managed to collect a DXCC on CW in his spare time. We are certain to hear something of him from G-land.

YOUR OPPORTUNITY—

to join the world-wide ranks of amateur transmitters! The Wireless Institute of Australia holds regular classes in Sydney to assist Sydney and suburban enthusiasts to obtain their Amateur Operator Certificates of Proficiency.

Write for particulars to the Class Manager, W.I.A., Box 1734, G.P.O., Sydney.

A.O.C.P. CLASS

The Victorian Division A.O.C.P. Class will commence on Thursday, 13th July, 1950. Lectures are held on Monday and Thursday evenings from 8 to 10 pm. Persons desirous of being enrolled should communicate with Secretary W.I.A., Victorian Division 191 Queen St., Melbourne (Phone FJ6997 from 10 am to 4 pm), or the Class Manager on either of the above evenings.

The PICK-UP OF TOMORROW

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AMPLION NOW OFFERS THE AMAZING

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CRYSTAL PICK-UP

Interchangeable head enables the playing of standard or long-playing records.

This is an entirely new departure in pick-up design, an advance which is reflected in its modern and striking appearance. It is a pick-up which sets a new and higher standard in sound reproduction.

It has an output some twenty times greater than any comparable magnetic type, and moreover it can be connected direct to any radio or amplifier without recourse to an equaliser. Features shown below which, together with the innovation of the interchangeable head for playing from fine groove recordings, make the G.P.20 the pick-up for the future, as well as the present.

- **20 times greater output** than comparable magnetic types.
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- Needle talk and motor rumble negligible. Record wear virtually eliminated.
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PRICES

G.P.20 Pick-up (Fitted with standard Head)	£4 17 6
G.P.19 Cartridge (Standard type)	£2 15 0
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OFF THE RECORD — NEWS & REVIEWS

The reaction of many readers, technical and otherwise, to the opportunities for better reproduction made possible by new pick-ups, speakers, and records during the last eighteen months, have produced a number of highly interesting viewpoints. It almost appears as though we should add a third classification to our listening ideas—one which fits somewhere between the medium fidelity standard, and the high.

I THINK this is so because of the fact that not yet are we able to use full-range equipment on present day recordings without running into many difficulties. Consequently I find many music lovers who are greatly attracted to the extension of range, particularly in the upper registers, but who are not prepared to overlook penalties either in scratch level, or in lack of clarity, to obtain it.

Those who are inclined to be more tolerant find the higher cost of extending their listening range over 10kc. rather more than they are prepared to stand.

The conclusion, therefore, seems to be that the optimum standards at the present time would allow an upper limit of about 10kc as being adequate, with the ability to cut it to a lower limit when required.

Another point of contention which is voiced many times, concerns volume. While many record enthusiasts like to hear an organ or an orchestra at high volume, many others cannot or do not wish to use more than low to moderate volume, but are definitely interested in wider range.

Apart from my own personal views, therefore, it seemed to me that there is a definite demand for equipment required to operate at not more than 2 or 3 watts, and with a sharply defined limit of about 10kc.

In case my more particular readers might gaze askance at a 10kc compromise as being beneath their notice, I should point out that the class of listeners I have in mind have as their reference the frequency response of the average radio receiver, which provides them with such a large proportion of their listening.

Recently I saw a frequency response curve of a good quality receiver measured from the aerial to the speaker output. At 5kc the attenuation from a reference of 1kc was about 10db. This means that the energy available to drive the speaker at 5kc was only one-third of that available at 1000 cycles.

BIG CONTRAST

This drop was due to the selectivity of the tuning circuits, and did not allow for deficiencies which might exist in either the loud speaker or its transformer.

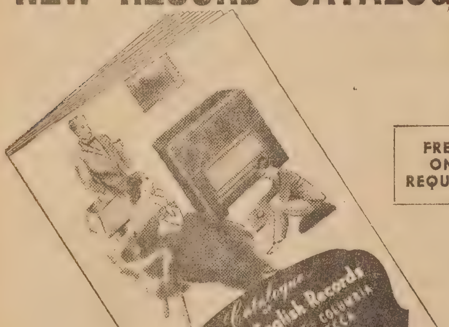
To such listeners, a sudden extension of range, including the speaker, to 10kc, represents a terrific change, and one which might well be considered as much as can be digested in one jump. To make available such an extension, on records at any rate, might well satisfy their desires for better quality for quite a while.

With these things in mind, I have spent some spare time during the last few months in working out some equipment to do all this, and have been pleasantly impressed by the results.

The greatest amount of effort went into the production of a loud speaker made up from various components I thought would suit. The speaker was based on a magnet assembly and suspension taken from a modern 12 inch speaker of modest performance, as representing a type likely to be available at a moderate price and not required to compete with the 15 and 20 watt models available at rather a high price.

To this speaker housing, I fitted a multiple cone of the type often seen on imported speakers, and after suitably building up the housing to fit, I succeeded in overcoming the

Music Lovers! Obtain your copy of this
NEW RECORD CATALOGUE



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20 For 6/-

Hard - chromium plated needles with green shanks. Radius of needle point guaranteed accurate to within the tolerance of .002"/.003". Each needle will play 20 sides, and up to 50 without damage to record.

Connoisseur Sapphire Needles .. 13/6 ea.

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Features are: silent—high power—constant speed — self-lubricating bearings—plays 10" to 12" records.

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World's best stories Novelettes in Pocket Book Storyteller 6D

various adhesive problems, and finally centring the cone.

Owing probably to the extra compliance introduced into the assembly by the afore-mentioned adhesive operations, the upper limit of this speaker gave up the ghost at about 10kc and the lower limit, because of the lowered cone resonance, dropped to about 55 cycles. Output was approximately the same as the original, although a volume reduction was required at the low end to preserve true bass.

Used with a wide range tuner, and mounted in a vented enclosure, this speaker has proved just about ideal for the conditions mentioned earlier —namely, medium-high fidelity at average room volume.

Added point to the relation of my speaker manufacture is given by the announcement that the Rola company is about to release a new loud speaker which is on exactly the same lines as my own. Readers of our magazine will remember that for some years I have been trying to persuade some Australian factory to try their hands at something not too pricey, but which would satisfy at least the major requirements of a good speaker.

NEW SPEAKER

Rola's effort, which I had the pleasure of hearing recently in Melbourne, is similar to their 12-0 model, but with a new cone assembly —actually three cones in one.

The main 12 inch cone has a 50 cycle resonance. An inner cone is attached to the voice coil, and a dome-shaped dust cap serves as a third cone producing the highest frequencies.

This design, according to curves produced by Rola shows that the bass end is improved by the lowered resonance as compared with the standard 12 inch type, and the upper register extended on a reasonably flat basis up to about 11kc at which a very sharp cut-off takes place.

This is a vastly superior result to those obtained by any Australian speaker of its class we have heard to date. Listening tests with recorded, tape music, and with a standard BFO, left me with an initial impression that the makers claims were well founded.

I am therefore happy to honor a promise, and congratulate the first manufacturer to give up a really good, every-man's speaker.

Being a bit careful about enthusiasm for any product, no matter how good, Rola will excuse me further comment until I have a chance to hear the speaker under home conditions.

Incidentally, Rola are not slow to appreciate the difficulties of using a wide range speaker indiscriminately. In fact, I think they are a little diffident in their approach to this matter, and may under-rate the enlightened listener's awareness in this respect. If the speaker is as good as my first impressions of it. I think they will be surprised at its reception.

Protect your new Records

with A.R.C. precision radiogram needles

To reproduce the full richness of harmonies and overtones in your recordings, and to protect the delicate groove on which these sounds depend, use an A. R. C. precision sapphire-point needle. Every A.R.C. sapphire-point is accurately ground to correct dimensions for finest reproduction and longer wear of both needles and records.

A.R.C. "Coronet" sapphire-point needle

- Ideal for multi or single-disc record players and radiograms.
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BELLING LEE *Quality Radio Components*

It is our policy to bring to the amateur and professional radio field in Australia only quality products in which an investment means a financial saving and an insurance of faithful and efficient performance. For this reason we are proud to mention a few of the good things made by Belling & Lee Ltd. They are obtainable from all Eddystone distributors throughout Australia.

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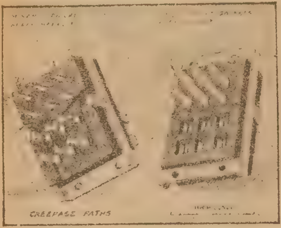


A new range of miniature inter-chassis Connectors, primarily for connecting one chassis or sub-assembly to another. Moulded from mineral-filled bakelite with mild steel surrounds. Each part carries half plugs, half sockets, all silver plated. Non-reversible.

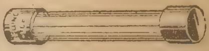
List No. 1 part	Flat Contact	Mould Size
L 610	4-way	1⅛" x 9/16"
L 611	8-way	1¼" x ¾"
L 612	12-way	1¼" x 1"
L 613	18-way	1¾" x 1"

Working voltage pin to pin, 1500 volts. Pin to flange, 2250 volts.

PANEL FUSEHOLDERS

L 356 Standard.—To fit fuse behind panel, yet retain accessibility. Bakelite, single hole fixing, bushed from panel, coin slot in carrier. Neat, robust and reliable, with soldier spills. Exceptionally low resistance. With L 1055 1 amp. fuse or as required.

STANDARD FUSE, 1¼" x 1¼"



L 1055 Ratings: 60, 100, 150, 250, 500 and 750 Ma.; 1, 1.5, 2, 3, 5, 10, 15 and 20 amp.

Our standard fuses, L 1055, up to and including 5 amp. are designed to (1) carry rated current for 1000 hours, failing on a 75% overload within one minute, and (2) break a surge of 500 amps. at 250 volts d.c. without damaging fuse or cartridge holder (B.S. 646 (type B) Spec.).

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35/6 Plus Tax

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A perfect joint every time in places where a full-sized iron cannot get.

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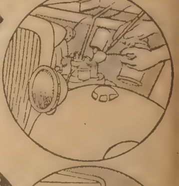
Odd jobs about the home or the car—put a touch of solder exactly where you want it on those "fiddling" electrical jobs.



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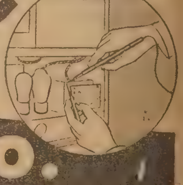
Accurate precision soldering in those inaccessible places without risk or damage to components or insulation . . a featherweight tool that can be used for hours without fatigue.



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DIODE NOISE GENERATOR

(Continued from Page 67)

e to add a few turns to the filament vinding to provide the extra .7 volts r so. This procedure should not ffer any difficulties to experi- ienters who are sufficiently ad- anced to construct and adjust VHF eceivers.

After dismantling the transformer, emove the outer layers of insulating ape from the windings. It should ien be possible to check the number f turns on the filament winding and etermine the turns per volt rating f the transformer. Most of these ransformers appear to be wound at bout 7 turns per volt in which case is satisfactory to add, say, 5 turns. he 6.3 volt tapping is still required or the 6X5-GT.

ILAMENT CONTROLS

It is necessary to be able to con- rol the filament temperature of the 1468 within very fine limits. This an be done by means of a rheostat series with the filament circuit ut, unfortunately, a rheostat with ufficient range of control is not apable of providing a sufficiently ne adjustment.

Our solution to the problem is to rovide two rheostats, one for coarse ontrol and one for fine adjustment. he coarse control is of 6 ohms re- stance and can be obtained from anufacturers. It would possibly ot be found in stock with most upply houses but no difficulty hould be found in obtaining it to rder.

As far as we know, it is not pos- ble to obtain 1.0 ohms rheostats. owever, we rewound the element a standard wire wound potentio- eter with a length of No. 28 SWG ire and the resistance worked out a fraction over the required 1.0 m. The rewound potentiometer as proved perfectly satsfactory in ervice, allowing very fine control the filament current and hence e plate current.

IETERING

Diode plate current in our instru- ent is measured with a 0-5 mA. eter which is provided with a shunt extend the range to 50 mA. This akes it possible to take current adings between about 0.1 mA. and mA. This will cover most re- irements but where a receiver ith a very good noise factor and a gh impedance input is being tested, ere may be some advantage in oviding a lower current range. A mc. receiver with a 300-ohm put would very likely be such a se. Possibly the most convenient ay would then be to use a meter ith a 0-1 mA. movement and pro- de shunts to permit it to read to mA. and 50 mA. respectively.

The value of the shunt can fairly sily be determined by comparison ith an accurate multimeter and t-and-try. We used an ordinary watt carbon resistor as a former which to wind the shunt and e correct resistance value was rived at with the resistor wound most to its full length with 35 SWG wire. The resistance of the 5 mA. meter movement in our case is 10 ohms.

The output circuit of the generator requires special attention. It is not possible to provide a single circuit which will ideally suit all requirements. However, our present circuit will suit most receivers, provided the frequency is not too high.

As shown in the circuit, the generator provides a balanced output suitable for feeding into receivers requiring a balanced input, such as a 300, 150 or 75 ohm transmission line. The load resistors must be adjusted to suit.

Unbalanced output for feeding co-axial cable is obtained by shorting the lower load resistor. This is conveniently done by means of a shorted co-axial plug, which can easily be removed when required. With the shorted plug in place, unbalanced output is taken from the upper co-axial plug.

In all cases the load resistors must be adjusted to suit the impedance of the co-axial cable and input of the receiver. Switched resistors would be a convenient way out of the problem but the additional capactiy and inductance involved would severely limit the high frequency range of the instrument. The only satisfactory method is to install resistors especially to suit the receiver being tested.

COMPROMISE

Even our circuit allowing push-pull output makes certain compromises in the matter of extreme high frequency output. In our next issue we will suggest an alternative circuit which, although it does not have the flexibility of the present circuit, should work at frequencies above 250 mcs.

The filament R.F. chokes are required to prevent external noise from entering the generator circuit and when operating in the push-pull connection the chokes are in parallel with the lower half of the load resistor. Therefore, they must present a high impedance at all frequencies at which the generator is to be used.

Our chokes were made by winding 22 SWG wire around ¼in diameter rod. After removal from the rod the chokes are self-supporting and can be soldered into circuit. The smaller chokes nearer the filament consist of 15 turns and the larger chokes consist of 40 turns. Unfortunately, the underneath photo was taken with only one pair of chokes in place.

Components should be arranged so that capacities shunting the chokes are as small as possible. Further, the relative positions of the small and large chokes should be arranged so that the mutual inductance between them is at a minimum.

MEASUREMENT

To take a reading of receiver noise factor, the receiver is set up with a meter to read the power output. With the noise generator connected but turned off, the gain is adjusted until the meter reads some convenient figure. The noise generator is then turned on and the diode current increased until the power output lead by the meter is doubled. (41 per cent increase in A.C. voltmeter reading.) The noise factor can then be calculated from the formula:

$$Fn = 10 \log 20 \times I \times R,$$

where, Fn = noise factor in db.
I = diode current in amps.
R = load resistance in ohms.

This formula may not give an absolute reading with the techniques it is possible to employ in the average workshop, especially at VHF, but it at least gives a figure as a basis of comparison for future adjustments.

More detailed information on the methods of measurement of noise factor, &c., will be given in next months' issue.

WE HAVE NOTICED:

- That the removal of glass-envelope type valves from the socket by grasping the envelope throws considerable strain on the glass-to-base cementing. Continued removal in this fashion can soon lead to a loose base and possible breaking of the leads. The same remarks apply to grid caps. The correct method is to grasp the valve by the base or to use a screwdriver or similar tool as a lever between the chassis and the underside of the valve base, levering first one side and the other, assisting gently with the free hand. Don't allow too much side movement otherwise with octal based valves, the locating key may break off.
- That many people wish to convert ordinary radio cabinets into vented enclosure speaker cabinets. Unless the cabinet is of very heavy construction this is not satisfactory as the light materials of commercial cabinets exhibit too many resonances. Unless the cabinet is particularly heavy, we recommend that the speaker be housed in a separate heavy cabinet with the tuner amplifier and record player housed in a table model cabinet conveniently placed.
- That some mica condensers sold are very much outside the normal tolerance. Condensers marked 100pf. have been found to actually be anything between about 30pf and 200pf. If the oscillator section of a converter valve fails to operate or tends to squegg, check this component by substitution of a condenser known to be correct.

MODELS: Technical Engineering Supplies. Blue Print Library. Castings. Latest Catalogue now ready, 2/-. **O. B. Bolton, Room 1, 70 King St., Sydney.**

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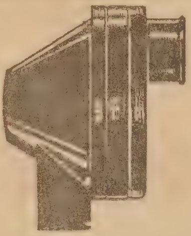

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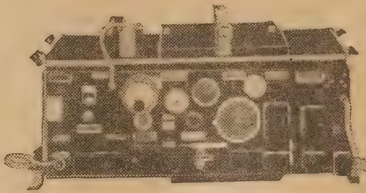

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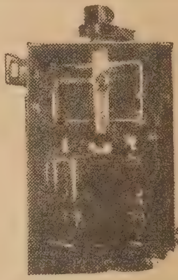

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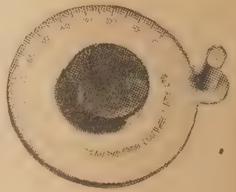

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PARAGON RADIO

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N.S.W.

YOU CAN'T BELIEVE ALL YOU SEE

(Continued from Page 11)

orizon, so if this imaginary horizon s not clearly fixed the eye gives uite a wrong idea of gradient. Fig. is a good example, for the lines unning along the peak seem to be ilted downwards at one end, when n fact it is level, simply because the rossing line has altered our standrd.

The more usual method of demonstrating this illusion is shown in Fig. 9, when no one would believe he heavy lines to be parallel, as n fact they are.

LLUSIONS OF MOTION

Illusions due to motion, entirely a elative term, are very numerous, he most familiar of all being that of the ordinary cinematograph; in this machine the series of images showing a moving object in slightly different positions, are thrown upon a screen. Thanks to the fact that these images ake time to die away from the eye, hey can be super-imposed to give he effect of smooth movement, instead of a series of uninteresting erks.

A very interesting demonstration of the fashion in which the eye forms a standard speed is shown by Fig. 10, in which a card has a slot cut n it and is fitted with another card behind equipped with a spiral slot. f this is looked at in a dark room when illuminated from behind, turnng the spiral disc will give the impression that a bright spot of light s slowly travelling upwards to disappear at the top and begin again at he bottom.

When this is watched for a few minutes steadily and suddenly stopped the bright piece does not appear o remain stationary, but seems to move downwards for quite a long ime, due to the relative impression of movement formed by the mind and the eye.

In another test (Fig. 11), the eye estimates the rate at which the card s moved by looking at the two inersecting lines at a distance of about 10 inches and moving the card up and down. The dark lines seem o swing slightly as if they were not drawn in a fixed position upon he paper.

BRIGHTNESS

No ordinary human being can estimate brightness successfully, and f a number of strips of transparent paper are pasted one over the other, as in Fig. 12, each square seems to be brighter at the left than at the ight by virtue of the contrast obained.

This is in no way due to tiring of he eye, as can be proved by illumination of the picture for only a fracional part of a second. From our earliest years, we have become accusomed to distrust our eyes, for no one imagines that a rapidly twirling match is, in fact, a ring of fire.

There is another experiment due o some sympathetic effect upon the nerve fibres of the eye, which are accustomed to deal with color. If an ordinary printed page is looked at near a brightly-lighted lamp for a moment, and a dark screen is then put between your eyes and the paper the printed letters will for a moment appear quite red, as the shield is suddenly removed.

If a disc is cut with a sector removed and is spun upon a long pin over the printed paper, as in Fig. 13, the letters seem quite red when observed through the gap. It is sometimes also noticed that if a red spot is looked at upon a sheet of white paper a green spot will be seen when looking at either part of the white surface. This is probably due to the retina in use with the red image becoming tired, so that the red components of the white light are afterwards not visualised and the complimentary color therefore predominates.

In any of these experiments, it is hardly practicable to distinguish between the eye and brain for, indeed, they are linked together by a mixture of custom, growth and carelessness, which can help the eyes to entertain or irritate with a facility attributable to no other forms of optical apparatus.

Try Fig. 14 as a final experiment. Spin the disc on a pin in a bright light and make a note of what you think you see. The disc should be about 3in diameter, with very thick dead black lines.

Watch out for the new
1950 edition of the
SHORT WAVE HANDBOOK
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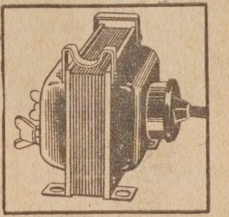
The Scope Soldering Iron really means something to those people who use a soldering iron regularly. There is no waiting for the iron to heat up; no frequent cleaning and tinning of the bit; no lengthy waiting for the work itself—no matter how large—to heat up. You simply press the switch ring forward and in 6 seconds terrific heat is generated at the soldering tip. This enables a rapid transfer of heat from the soldering tip to the actual job. Operating from 2.5/6.3 volts A.C. or D.C., Scope may be used from A.C. mains with a suitable transformer or accumulator. Servicemen, factories and laboratories like Scope for its economy and its speedy, efficient use. Price, 43/6, plus a full guarantee.
Descriptive pamphlet available on request.



The transformer illustrated is designed to supply 4 volts from A.C. mains for the Scope Soldering Iron. It is available at extra cost on request and may be used for continuous operation. Price, 30/6.

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The Scope Soldering Iron is ideally suited for use in factories, laboratories and for work normally met by servicemen. It is 10" long and weighs only 3½ ozs. It is supplied with or without the transformer, which is also equipped with a special holding bracket for the iron when it is not in use.

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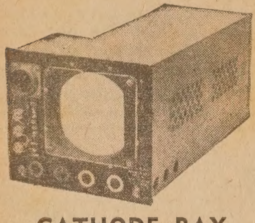
S.5.14

RADIO SPECIALS



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This is an ideal unit to be converted to an oscilloscope or stripped for the excellent parts, valves, etc.

Parts are 1—5BP1 Valve complete with socket and nu-metal shield, 6—6AC7 (1852) Valves, 3—6H6 valves.
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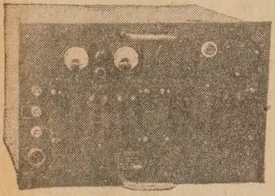

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Parts Include.
2 — AV11 Valves.
2 — Cyclatron Valves.
2 — 4-Pin Ceramic Sockets.
1 — 24 Volt Motor.
2 — .01 5000 Volt Working Condenser.
1 — .02 10,000 Volt Working Condenser.
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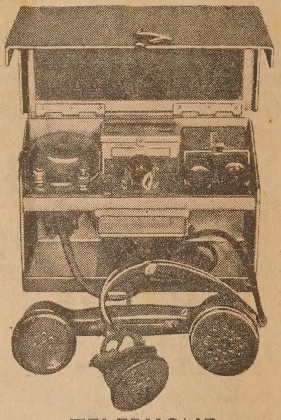
3 — Transformers (Heavy Duty).
1 — 0-100 Volt AC Meter which is an 0-1 ma movement with 1 ma Dry Metal Rectifier fitted.
1 — 0-50 ma DC Meter.
(and many other parts such as stand off insulators, coils, etc, easily worth £20, our price only **£4/19/6**



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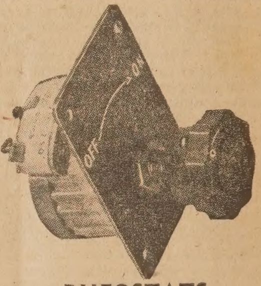

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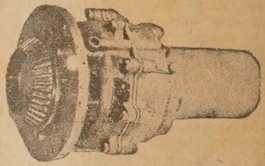

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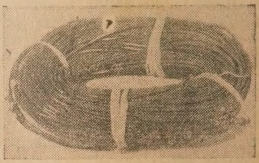

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ANSWERS TO CORRESPONDENTS

B.S.S. (Manyung, Qld.) sends in some nteresting questions for the Answer om page of Radio and Hobbies.

A. Thanks for the questions, B.S.S. 'e will answer them as soon as possible n the appropriate page of Radio and obbies.

W.K. (Bankstown, NSW), is enthusiastic bout making a start with radio experi-nenting and asks if we can help him vith a circuit. People from whom he ıas asked advice have told him that crystal sets are out of date.

A. A number of crystal set circuits ıave been published in Radio and Hob-ies from time to time. Although they nay be out of date commercially, crystal ets are a good way for a beginner to btain some experience. A circuit was ublished in the Reader Built It section f the May issue and you may be inter-sted in studying it. A crystal set was lso described in the September, 1948 issue f Radio and Hobbies, and again in the ustralian Hobby Handbook which is now vailable at bookstalls. We can supply ou with the circuit through the shilling uery service. However, we do not file opies of descriptive articles. We can lso supply the circuit of a two valve eadphone set through the shilling query

H.R.C. (Cobden, NZ), reports that he has ad an interesting time experimenting vith an HMV pickup along the line ecently suggested. He has also installed ıe voice coil filter system for his Axiom speaker and is very satisfied with the verall results.

A. We read your report with interest. .R.C., and are pleased that you were able achieve success. We are pleased to ote also that your friend was successful ith the amplifier using KT61 valves.

E.J.R. (Townsville, Qld.), writes to tell s of some experiments he has conducted vith wire recording. After a consid-rable amount of work he has succeeded n constructing a reasonably satisfactory nit, but until manufacturers are able to nake special parts available in kit form e does not recommend wire recorders o home constructors. He says, "From my xperience, I would not recommend any-ne to take on the construction of a wire ecorder, unless he has plenty of time nd patience. He will also need a lathe nd a drill press, and for the adjustment f the amplifier and oscillator, he will equire an audio signal generator and, possible, a CRO."

A. Many thanks for your letter E.J.R. nd we found it very interesting. We gree with most of your remarks.

A.A.C.R. (Christchurch, NZ), says some ry nice things about Radio and Hobbies d says that he particularly likes the rviceman articles and the Shortwave otes. He also tells of an unusual ser-ce experience with different types of nverter valves.

A. Thanks for the nice letter, A.A.C.R. e were pleased to hear that you enjoy ading Radio and Hobbies and, in parti-lar, the Serviceman articles. Thank u for taking us to task over the 6A8-T. Actually we meant that the 6A8-GT as not available in Australia but, since blishing the article, we found that one mpany was now importing these valves om Britain.

H.E.B., Geelong, Victoria, sends in a estion for the "Here's Your Answer, om" page of Radio and Hobbies.

Thanks for the question H.E.B. We ill deal with it as soon as possible.

S.C.W., Campsie, NSW, writes to tell that information supplied through the ery service helped him eventually to nd the trouble with his commercial set. ne set featured a shunt fed oscillator il so that the voltages on the valve ere quite OK even though the coil had ecome open-circuited at one of the ter-inal lugs.

A. Thanks for the letter S.C.W. We ere very pleased to hear that your set now working well again. We will pass ur experience on to the Serviceman ho Tells. He may care to print the tter which should be of interest to many ther experimenters.

F.S.A. (Ashfield, NSW), wonders why we have not described a dual wave receiver using separate mixer and oscillator valves.

A. There are no difficulties in the use of a separate high frequency oscillator valve and we have adopted this procedure in a number of our amateur and short wave receivers. The 2JU Eleven De-Luxe and the Short Wave Seven are typical examples. However, with dual wave receivers where the degree of bandspread is not very great and the order of bandspread and frequency calibration are not usually required to be over good. it is very difficult to make a case for separate oscillators. There are no special difficulties in making the circuits function correctly. However, since an extra valve is required, the cost of a receiver using a separate oscillator is greater. Both the circuits mentioned are available through the one shilling query service.

E.L.W. (East Hawthorn, Vic.), would like to obtain the circuit of an a-c version of a multimeter, the a-c version of which was described in the July, 1939 issue of Radio and Hobbies.

A. Sorry, E.L.W., but circuits as far back as 1939 are no longer available from the files. However, the circuit of the AC/DC Checkameter is available through the shilling query service. The Checkameter is a standard multimeter suitable either for service work or an experimenter's workshop.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C, GPO, Sydney.

E.D.H., Christchurch, NZ, sends in a subscription and also says some very nice things about R&H. He particularly enjoys Ray Simpson's Short Wave Notes and expresses satisfaction with the shilling query service.

Thank you very much for the nice remarks and good wishes E.D.H. It is very nice to know that our magazine is appreciated in NZ. We have passed your subscription on to the appropriate department and no doubt they have forwarded your receipt by now.

D.G. (Launceston, Tasmania) writes in and asks where he can obtain copies of circuits for four and five valve AC operated receivers.

A. Copies of back issues of R&H are usually not available for more than approximately three months back. D.G. However, we can in most cases supply circuits, parts lists, and wiring diagrams through the query service. The cost is 6d per piece so that a circuit, parts list and wiring diagram would cost 1/6. If you drop us a note enclosing the appropriate money and information as to the type of set you require we will post the necessary information to you.

N.C.D. (North Collie, WA) reports having built up the guitar amplifier described in the August, 1948, issue and having operated it with great success. He is using a commercial pickup unit and finds that the preamplifier stage is not necessary.

A. Thanks for your letter and we are very glad to hear that the unit is operating so successfully. We explained about the preamplifier stage in the original issue and the output of your unit is apparently quite high. Yes, the home constructed amplifier instrument certainly represents a big financial saving over a similar commercial guitar outfit. Many thanks for your kind remarks.

K.H.S. (East Malvern, Vic.)—Would like some information on a particular service valve type. He also asks about a pickup he is apparently thinking of purchasing.

A. We regret that we cannot help you about the valve as it does not appear on any of our lists. The pickup you have in mind is an excellent type for general use, attachment to receivers, &c. It has low needle pressure and good compliance which contribute to low record wear. A certain amount of arm resonance is evident at 50 cycles. This has been introduced to boost the low frequency output and balance the reproduction for average conditions without special compensation. Many thanks for your kind remarks with regard to our magazine.

W.T.A., Mt. Isa Mines, Qld., sends in a subscription to R & H and also asks if we can supply him with a list of the world's B/C stations and also a list of the world's amateurs.

A. Unfortunately W.T.A. we cannot supply the lists you require. In fact we very much doubt whether a complete list of B/C stations has ever been prepared. We do, however, intend to bring out a new issue of the Australian Shortwave Handbook in two or three months' time which will contain lists of Australian amateur and B/C stations. It is possible to obtain a complete list of the amateurs throughout the world by writing to Radio Amateurs' Call Book Inc., 608 Sth. Dearborn St., Chicago Ill., USA. The subscription is seven dollars per year for four issues or two dollars for an individual issue.

Thanks for the subscription W.T.A. and we hope that the above information will be of some help to you.

A.E.M. (Mackay, Qld.) sends in a subscription to R&H and also a suggestion for a future series of articles on practical receiver and transmitter design. He also says that he has been told that the copies of R&H which are posted contain more errors than those which are bought from the bookstalls.

A. Thanks for the subscription, A.E.M., and for the suggestion. We may be able to do something about articles of the general type you mention in the future. It is impossible for the copies of R&H to vary as your friends suggest. The issue is printed on rotary presses similar to those used for newspapers and once the presses are started they are allowed to run until the required number of copies is printed.

L.D., Indian Secondary School Lautoka, Fiji Islands, sends in three questions which we will answer in full in the Here's Your Answer, Tom section of R & H as soon as possible.

F.R.T. (Murchison, Vic.) sends in the case history of a mantel set which suffers from frequency drift. He suggests that we refer the matter to the "Serviceman Who Tells."

A. We shall do as you request, F.R.T., and see whether the gentleman in question can offer an explanation of the trouble. We agree that it is unusual.

N.G.D. (Dungog, NSW) is a reader who has several questions to ask through our "Answer Tom" page.

A. Many thanks for your letter, and the questions you ask are certainly of the type which bother beginners. We shall do our best to answer them in the next couple of months.

T.McC., (Ladysmith, NSW) has an anecdote for the Serviceman.

A. We have passed your letter on to the Serviceman with the suggestion that he does not overlook to answer his mail. Maybe he'll take the hint!

Wanted to Buy, Sell or Exchang

Readers wishing to buy, sell or exchange goods are invited to insert an advertisement on this page. The cost is 1/6 per line; approximately 5 words to a line. Advertisements for the next issue must reach our office by NOON WEDNESDAY, June 14, 1950. Dealers' Advertisements not accepted.

FOR SALE: R & H, 1949, all except Nov. 13/9. 1948 all except April, Aug., 15/9. 1947 all except Jan., Feb., Mar., April, 8/-. 1946 Have April, Aug., Sept., 3/-. 1942, Six, 6/-. 1941, Five, 5/-. Free lottery ticket to buyer of whole lot. £2/10/-. Please add postage. **C. Goodison, 23 Saunders St., West Coburg, N.13, Victoria.**

FOR SALE: AR8 receiver, £15 or near offer; PA5 amplifier with 10" speaker, and Garrard record player with crystal P.U., £15. Also complete radio course, £6/-/-. **B. Dowie, 54 McAdams St., Maffra, Vic.**

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SALE: English Recording Equipment (portable) Incorp. 20 watt amp 15,000 C.P.S., 3 mile inputs, magnetic cutting head, 2 S.T.C. M.C. mikes, 1 ribbon, cables, stands, transformers, &c. Portable P.U. for copies, cost approx., £450. Must sell, accept offer. **1 Elizabeth St., Parramatta. UW9302.**

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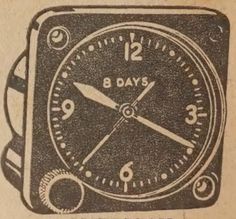

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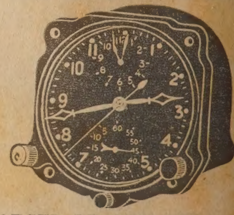

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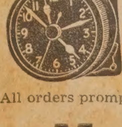

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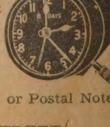

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